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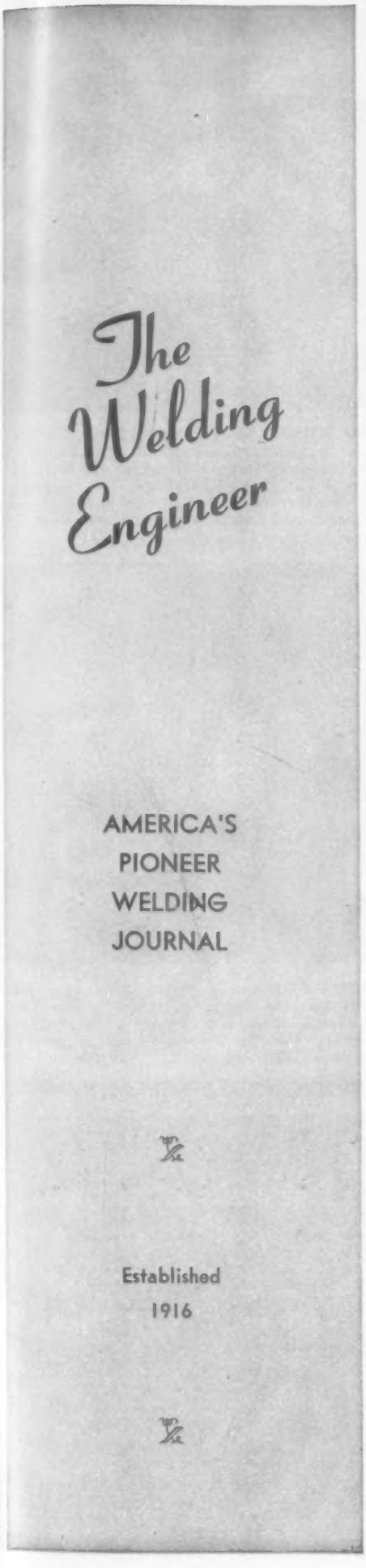



# *Freedom to Pursue Happiness*

One hundred sixty-eight years ago the founding fathers of this nation proclaimed, in the Declaration of Independence, that every man was entitled to life, liberty and the pursuit of happiness. Down through these many years each generation of Americans has ratified these pronouncements in mind and heart.

Change is inevitable and must be accepted as a part of advancing civilization, but certain basic precepts must never be changed if we are to remain a free people. The most important of these are the rights to life, liberty and the pursuit of happiness as laid down by the Declaration of Independence.

Now, as we are engaged in the greatest war this troubled planet has ever known, we are told of new concepts for free people—the Four Freedoms: freedom of speech, freedom of religion, freedom from want and freedom from fear. Let's see just what these mean.

Freedom of speech is a basic right that has always been enjoyed by Americans so long as libel or slander—speech which would injure the character of another—is not involved. Decidedly, it must be maintained, or liberty is non-existent.

Freedom of religion is the oldest freedom enjoyed by the white man on this continent. The desire of the Puritans to worship freely led to the early settlement of Massachusetts. From 1620 on (with the exception of brief periods of intolerance) our forefathers have been able to enjoy the religious teachings of their choice. Freedom of religion is important, certainly, but it is not a problem of today.

Freedom from fear is not possible. It may be obtained only in a Utopian world bereft of automobiles, disease, death, snakes, mice, schoolteachers and numerous other bugaboos which, depending upon age and sex, have filled hearts with fear. Shall criminals enjoy freedom from fear of punishment? Life would indeed become a battle royal if such a condition came about.

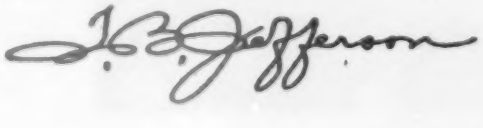
Freedom from fear, in the broad sense, is out of the question. Perhaps the originator of the Four Freedoms meant to imply freedom from the fear of unjust political oppression—we heartily concur with the desirability of that objective.

Freedom from want is another chimera. It might be desirable to a limited degree as emergency social relief, but very few of us would want to be wholly free from want if we realized all the consequences. Without the spur of necessity, ambition is killed and progress is no longer possible. Freedom from want, therefore, can lead only to stagnation. It holds little for resourceful, energetic and self-reliant Americans.

Instead of four specific freedoms, why not only one—the freedom to pursue happiness? This freedom—as the signers of the Declaration of Independence foresaw—is limited only by the individual's own efforts. He can rise to whatever his talents and ambitions will permit him to achieve.

All men are not equal in ability, but all should have equality of opportunity within the limits of their ability. All should be given the right to follow the upward path leading to happiness. This is the only real freedom, and the only freedom we need.

*"From every mountain side*
*Let freedom ring."*



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★CONSTRUCTION

# Welded Ships Without Distortion

**What causes those perplexing and troublesome locked-up stresses? Can they be avoided? How? These three questions, the most important confronting shipbuilders, are answered here by a man who knows from long experience.**

*By* **M. Q. CELLERS**
Seattle-Tacoma Shipbuilding Corp.

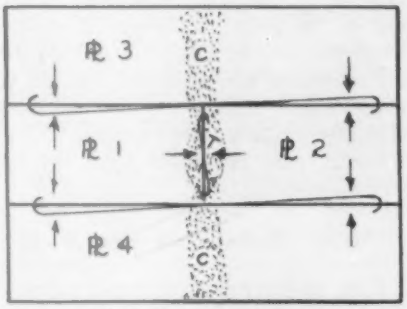



*Fig. 2—If these four plates are fitted and tacked before welding, shrinkage in the center butt weld (between plates 1 and 2) will probably result in buckling.*

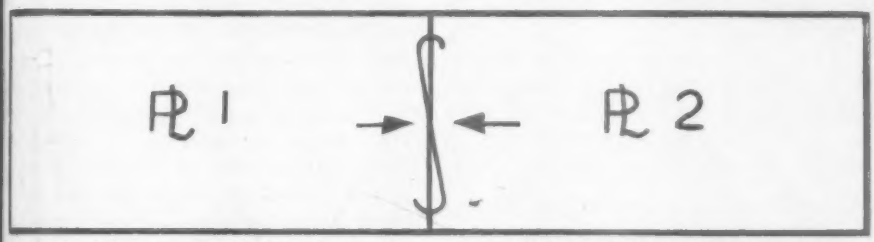



*Fig. 1—When two plates are welded together, they tend to shrink as indicated by the arrows.*

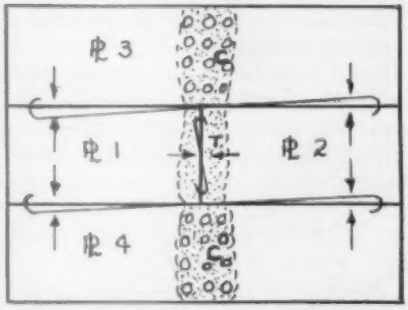



*Fig. 3—Flame-shrinking in the compressive stress areas (C) will remove buckling but it will not entirely remove the stresses.*

AN IMPORTANT difference in the construction of ships by welding rather than by riveting lies in the reaction of the metal at the joints. If metal is subjected to high heats, such as are produced by the welding arc, and the consequent shrinkage is restrained, the resulting locked-up stresses can sometimes cause fractures. The joints of welded steel members shrink upon cooling because the weld metal is molten when deposited and therefore expanded to the limit. This shrinkage draws the members toward one another as indicated in Fig. 1.

In riveted construction, the exact opposite is true. The upsetting of rivets in the rivet holes and the caulking of plate edges tends to expand the structure, though the expansion is seldom great enough to take into consideration. For this reason, no particular order of erection in riveted construction need be followed except for convenience. The same applies to subassembly. The riveted hull may be erected and bolted up in any order or manner that will get it together.

### Free Shrinkage Vital

This is not true of welded construction. Because of welding shrinkage, as much subassembling as possible should be done in the shop so that the shrinkage of the subassemblies will not affect the hull as a whole. Each member or subassembly must be erected and welded on the ways in a manner that will allow free shrinkage when that part is welded into the hull.

If erection of a welded hull is carried out without regard to method or order (as is erection of riveted hulls), the result will be many fractures during and after erection and a hull of unfair lines. Such haphazard construction methods not only complicate the welding problems which would exist regardless of method and order of erection but actually create additional problems. This statement is borne out in our discussion of the method and order of fitting and welding the four plates shown in Fig. 2.

To understand better what happens when two pieces of metal are welded together, let us go back many years and consider a particular problem which confronted the iron founders. When making a pattern for a casting, they found it necessary to expand or make it larger than the intended size of the casting. Good foundry practice for steel and cast iron requires pat-

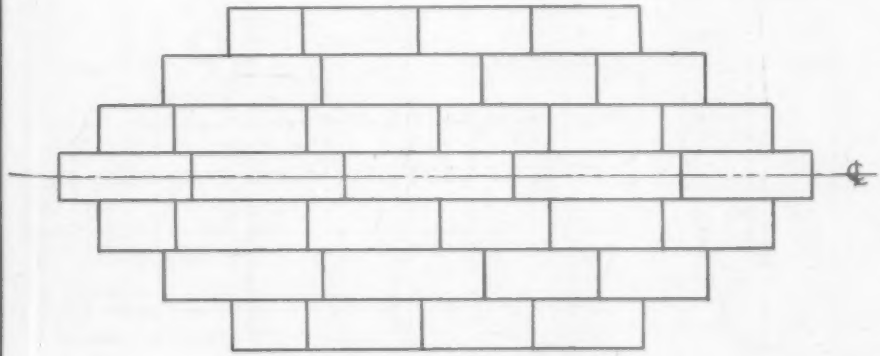


*Fig. 4—Plate layout plan of bottom shell.*

terns that are made ¼ in. per foot oversize. The shrinkage of the metal as it cools from the molten state to atmospheric temperature will reduce the casting to the desired size.

A casting is a single unit and has but one shrinkage. A complication may be introduced, however, if it is not of uniform thickness. Thin sections will cool and solidify while heavier sections are still in the plastic stage, and this sets up opposing stresses within the casting. Such stresses can be eliminated through stress relieving.

### Many Shrinkages per Weld

The same principles, on a larger and more complicated scale, are involved in welded steel construction. A welded structure is composed of many units and has many welds to shrink. Furthermore, each weld may have many shrinkages since it shrinks first upon being tacked and as many times thereafter as there are passes or beads. Single-pass welds should be used whenever possible as they result in only one shrinkage. Like castings, welded structures may be relieved by stress relieving, but in shipbuilding it is possible to relieve only the smaller hull subassemblies in this way.

Because of the many shrinkages involved in welding, we may get a shrinkage of ⅛ in. in a butt weld only ⅝ in. wide; an object 6 in. wide would have to be cast in order to obtain an equivalent amount of shrinkage.

A welded steel hull is composed of many units such as subassemblies and individual pieces. Each of these presents shrinkage problems in its fabrication, and still more problems are presented when the various pieces and subassemblies are welded into the hull. If the fabrication and subassembling is not carried out in the proper manner and order, these units will have opposing stresses in them beyond a safe minimum. The hull will likewise have opposing stresses if the individual pieces and subassemblies are not erected and welded into it in the proper manner and order.

### Two Facts, Seven Rules

The problems involved can generally be simplified if we bear constantly in mind two facts and several rules used in determining Method and Order of Erection and its coördination with Method and Order of Welding. The two facts are:

(1). Weld metal shrinks.

(2). Welding heat shrinks the parent metal.

Some of the rules for controlling shrinkage are:

(1). Allow for weld shrinkage in lofting. Templates should be expanded and excess material should be left where necessary.

(2). Erect and weld in a manner that will allow shrinkage toward the point of welding.

(3). When welding a rigid unit, start in the center and weld toward the free edges.

(4). Weld junctures of framing before the framing is welded to the plating.

(5). No member should be welded to another member until shrinkage has taken place in both. An exception may be made when both members can be shrunk evenly after welding them together.

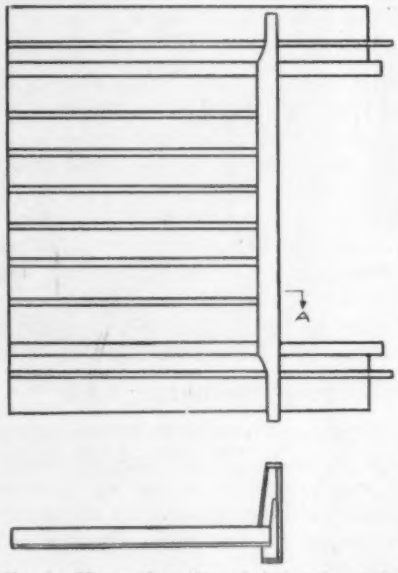


Fig. 6—Plan and section of deck subassembly.

(6). Consider the many factors which affect weld shrinkage.

(7). For the sake of fairness (a factor affecting the strength of a hull), welding should be kept evenly balanced both vertically and horizontally.

Because space does not permit, we will not go into detail regarding any of these rules or the shrinkage problems encountered in individual welds. We will, however, discuss in general the problems which are involved in prefabricating the principle subassemblies and in welding them into the hull. In this discussion, it is assumed that the lofting, the weld preparation, the simpler aspects of fitting and the welding technique and procedure are proper.

### Two-Plate Shrinkage

Let us first consider two plates which are to be butt welded together (Fig. 1). The arrows show the direction of plate movement because of weld shrinkage. After these plates have been welded together and have cooled to atmospheric temperature, we find a shrinkage of 1/16 to 3/16 in. at right angles to the weld. There is also shrinkage parallel to the weld, but it is not as great as the shrinkage at right angles because of the restraint afforded by the stiffness of the plating. There is little locked-up stress parallel to the weld if shrinkage toward the point of welding is free.

If shrinkage toward the point of welding is restrained, we get the same result as when we test a plate in tension. As the tension is increased, the specimen reduces in area because of the shrinkage across it. In allowing unrestrained shrinkage toward the point of welding, we simply prevent this tendency toward reduction in area. The restrained area for each weld extends on both sides of the heated zone for one-half the distance to the next weld. Since the area of the weld and the portion in tension adjacent to it is small in comparison to the restraining area, we may disregard what little stress there is parallel to the weld.

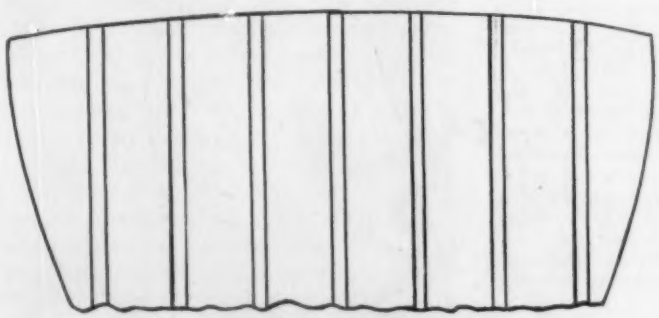


Fig. 5—Bulkhead with vertical stiffening.

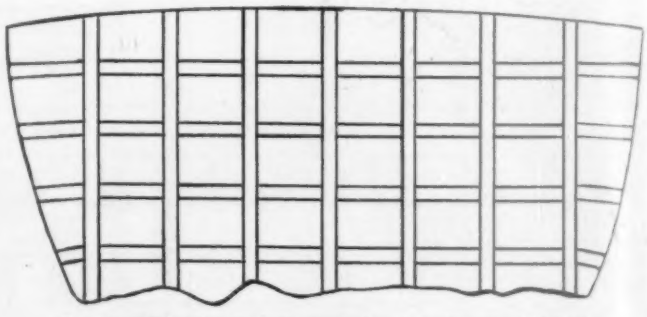


Fig. 7—Bulkhead with both vertical and horizontal stiffening.

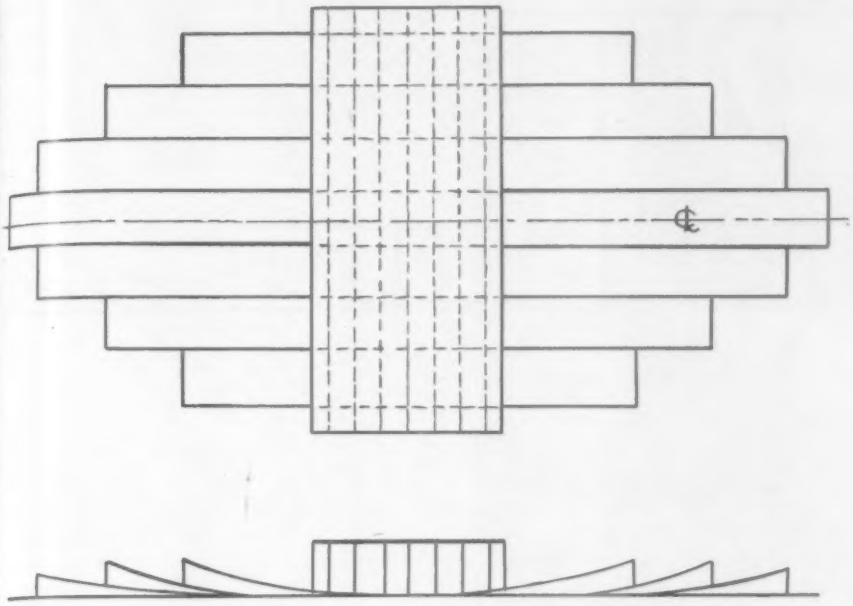


*Fig. 8—Bottom shell and first double bottom sections.*

### Four-Plate Shrinkage

Now suppose we have long plates to be welded on either side of plates one and two (Fig. 2). Let us suppose first that these four plates are all fitted and tacked together before any welding is done; in this case, neither order of welding nor method of welding can produce the desired minimizing of stress. While free shrinkage at the long seams (direction indicated by arrows) would not affect the plating as a whole, the shrinkage of the butt between the center plates and its resistance by the two side plates would result in buckling. There would be tension (shaded area "T") at the butt of plates 1 and 2 and compression (shaded areas "C") opposite the butt in plates 3 and 4. Buckling will be present unless the two side plates are rigid enough to restrain entirely the enormous pull of shrinkage at right angles to the butt weld of plates 1 and 2. But if the two side plates are rigid enough to restrain the shrinkage, there will probably be a fracture between plates 1 and 2. This fracture may or may not come in the weld.

### Locked-up Stresses

Such a plating subassembly may be taken as typical of bulkhead, bottom shell, tank top, side shell and deck plating. Can subassemblies fabricated with such locked-up stresses as those just described have the strength the designing architect intended they should have? Obviously not. And if subassemblies fabricated in this manner are erected and welded into a hull in the same manner, thereby locking up additional stresses, how can the hull possibly have its required strength?

The reader may say such stresses can be overcome by flame-shrinking. But can they? Let us take the subassembly just discussed and consider what takes place when it is flame-straightened (Fig. 3). Heating will be done in the compression areas ("C") which are caused by the weld shrinkage. While the result is the elimination of buckling and the structure is fair to the eye, opposing stresses between the original stress areas may still remain because of over- or under-shrinkage. Locked-up stress is not always apparent to the eye.

### Flame-Shrinking Difficulties

The tendency generally is to overshrink. We start with opposing stress in the original compression areas. Application of the heat then converts these spots into tension areas with compression between them. Buckling has been removed but not stress.

Shrinking of subassemblies should always be done before erection on the ways. If there are other courses of plating to lock in both the compression and tension areas, then shrinking does not eliminate but increases stress because of the resistance to shrinkage of the additional plating. Thus shrinkage done after the subassembly is welded into the hull increases stress because of the restraint provided by the rest of the hull (considering that the hull has considerably opposing stresses due to faulty erection and welding methods).

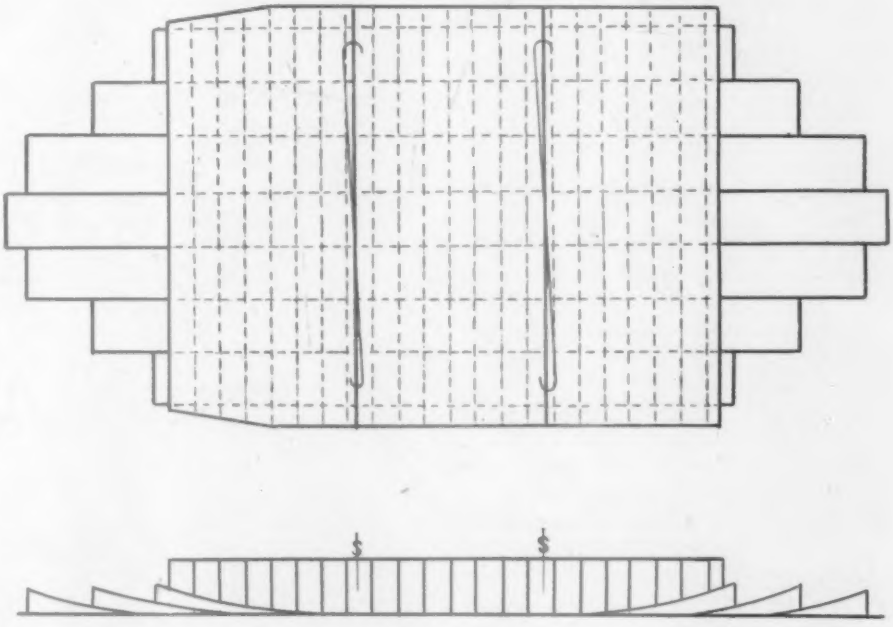
Heating and quenching is very detrimental to high tensile steel, which contains approximately 0.30% carbon. Regardless of the analysis of the steel, however, flame-shrinking should be kept to a minimum because of the saving in man-hours. The necessity for it can be almost entirely eliminated through the application of a proper erection and welding sequence.

### Hull Structure Subassembly

We will next discuss erection and welding methods which will reduce stresses to a safe minimum if used in both subassembly and hull erection. Such assemblies will be relatively fair and therefore easier to erect to other sections.

Major stresses in the plating subassembly we have just been discussing (Figs. 2 and 3) can be avoided by first

*Fig. 9—Bottom shell and double bottom sections. The latter are clamped and then welded to the bottom shell.*



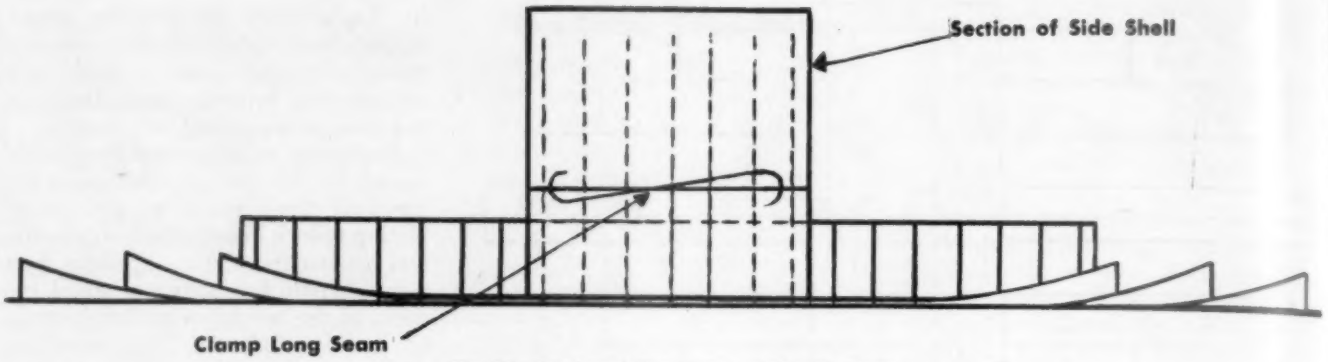



*Fig. 10—Erection of first section of the side shell.*

fitting and welding the butt in the center course (plates 1 and 2). If the two side plates are used to maintain alignment (Fig. 4), they must be clamped to the center plates in a manner that will permit unrestrained shrinkage toward the point of welding. After the shrinkage between the center plates has taken place, the two long seams may be tacked and welded. With proper fitting and welding, the result will be a fair plating assembly with a minimum of locked-up stresses. The compression and tension areas previously discussed are non-existent because we have eliminated their cause.

Obviously, the success of a welding job depends as much upon proper method and order of erection as upon the proper welding technique and procedure. This means that fitting is subordinate to welding, and that welding must control both design and construction.

If this plating is for bulkhead, deck or shell subassembly, and stiffening or framing runs in one direction only (Fig. 5), the observance of (*a*) proper method and order of erection, (*b*) proper method and order of welding and (*c*) proper welding technique and procedure will hold stresses to a safe minimum. The plating should be welded before erection of the stiffening.

### Deck Plates

Suppose that the subassembly of Fig. 6 is for a section of deck and has a hatch beam running at right angles to the transverse beams. Suppose also that welding will not shrink the hatch beam longitudinally as much as the welding of the transverse beams will shrink the plating longitudinally. Under these conditions, the hatch beam must not be tacked to the plating or to the transverse beams until the latter have been welded to the plating. To do otherwise would restrain the longitudinal shrinkage of the plating. If the welding of the transverse beams to the hatch beam is going to shrink it longitudinally, that shrinkage should take place before the hatch beam is tacked or welded to the plating. To do otherwise would lock up too much longitudinal stress in the beam.

### Bulkheads, Double Bottoms

If the plating is for a bulkhead subassembly that has stiffening running in more than one direction (Fig. 7), welding should progress from the center outward, and the junctures of the stiffening should be welded to the plating ahead of the stiffeners.

If the plating is for a double bottom subassembly which has a center vertical keel and longitudinal girders off the center line, the junctures of the floors to keel and girders should be welded while all are clamped to the tank top. This allows both transverse and longitudinal shrinkage of these members and does not affect the plating. No tacking of any member to the plating should be done until welding has reached that member. This procedure allows free shrinkage of the shell plating toward the point of welding and does not affect the other members.

Subassemblies erected and welded as described above will be fair and relatively free of locked-up stresses.

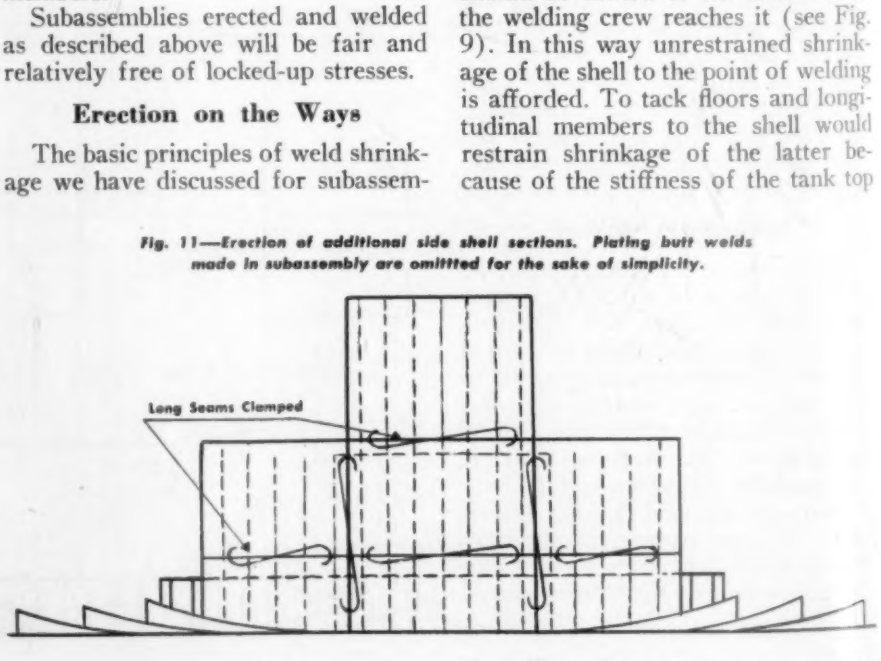
### Erection on the Ways

The basic principles of weld shrinkage we have discussed for subassemblies hold true also for erection and welding on the ways. The same rules used in subassembling to minimize or avoid locked-up stresses and distortion must be adhered to on the ways.

Erection and welding of the bottom shell (Fig. 8), whether erected by subassembly or piece by piece, will be done as previously described for the welding of plating subassemblies. The double bottom sections will have been allowed to shrink freely in subassembling, and the only additional shrinkage involved will be that from welding of the sections together. However, the bottom shell, as a unit, will shrink considerably when the floors are welded to it. Allowance for this shrinkage must be provided.

Each unit of the double bottom should be clamped to the bottom shell in a manner that will not restrain shrinkage of the shell. Each section should be welded to the next section nearest midship before being welded to the shell. Welding should start in the middle of the first section erected (Fig. 8) and proceed fore and aft from that point. Welding should be done floor by floor, and no member should be tacked to the shell before the welding crew reaches it (see Fig. 9). In this way unrestrained shrinkage of the shell to the point of welding is afforded. To tack floors and longitudinal members to the shell would restrain shrinkage of the latter because of the stiffness of the tank top

*Fig. 11—Erection of additional side shell sections. Plating butt welds made in subassembly are omitted for the sake of simplicity.*



and longitudinal members. The result would be tension in the shell and compression in the tank top and longitudinal members, and such stresses would usually show up in the warping or buckling of the latter members.

### Bulkheads, Side Shell

Transverse and longitudinal bulkheads may be erected and welded to the tank top at any time, but they must not be tacked or welded beyond an unwelded butt or juncture in the bulkhead—or between double bottom sections until those butts or junctures have been welded.

As soon as erection and welding of the double bottom sections (Figs. 8 and 9) have progressed far enough, the first subassembled section of the side shell (Fig. 10) near midship may be erected. This section is clamped to the tank top or bilge strake and tacked to transverse bulkheads or other transverse members. Welding may start at any unwelded transverse member nearest the center of the first section of the shell erected, and it proceeds fore and aft from that point. Vertical butts between the sections are welded as they are reached in turn.

Welding of the shell's long seams (Fig. 11) must be kept about one section behind the welding mentioned above. Possibly the reader is now asking himself how locked-up stress is overcome in welding the shell long seams. Well, the shrinkage we get in the long seams is transverse to the hull and is not as dangerous or as great as longitudinal shrinkage since the hull of a vessel receives more longitudinal than transverse stress. The transverse shape of the hull does not greatly restrain shrinkage except in the dead flat section near midship. Here the shell is generally straight from keel to bilge strake and from bilge strake to main deck. In this section, the locked-up stress in the long seams can be reduced by peening or else by strongbacking the shell out at the seam so as to open the butt. In the latter event, weld shrinkage will bring the plating in the seam area back to a near normal position.

### Strongbacking

It is well to mention here that proper strongbacking cannot be overemphasized as a factor contributing to the overall strength of a welded hull. If transverse plating butts are not strongbacked sufficiently to hold the plating in a straight line or to the proper contour, the result will be compression or tension at that point. If shell long seams are not held to the proper longitudinal shape, but are permitted to become buckled or marcelled in fitting, the longitudinal framing and decks will bear the brunt of any longitudinal stress and must break before any of that stress can be transferred to the shell plating. Strongbacks should not be placed so as to restrain contraction.

### Deck Erection

Erection of decks, including the main deck, may begin with the section near midship (Fig. 12) as soon as the erection of the shell permits. The deck must be clamped to the shell until unrestrained longitudinal shrinkage has taken place in both. If there are two transverse bulkheads under this section, they may be tacked to the deck and the deck may be tacked to the shell between them. Any longitudinal bulkheads between the two transverse bulkheads may be tacked to the deck. If the longitudinal bulkheads run fore or aft beyond these two transverse bulkheads, however, they should not be tacked or welded to the deck beyond any transverse bulkhead until they have been welded to that bulkhead. In no case should a member such as shell, deck, bulkheads or girders be tacked or welded to any other member beyond an unwelded butt or juncture in either member.

Care should be taken to see that the progress of fitting and welding is not impeded by the hanging of steel. Steel should not be hung until the job is ready or until its presence will not interfere with work on previously erected sections.

This concludes our discussion of the general erection and welding of the hull. To go into details on the erection and welding of the bilge strake, engine girders, shaft alley, bow and stern, hull structure near the bow and stern (which may not be readily subassembled), superstructure, hatch coamings, king posts, masts, etc., would take many words and drawings. Suffice it to say that the construction methods are basically the same as those already given.

A vessel constructed in the manner outlined is relatively stress-free and is stronger than a riveted hull. Barring design faults or an unnatural death, she will give as good an account of herself as any vessel could.

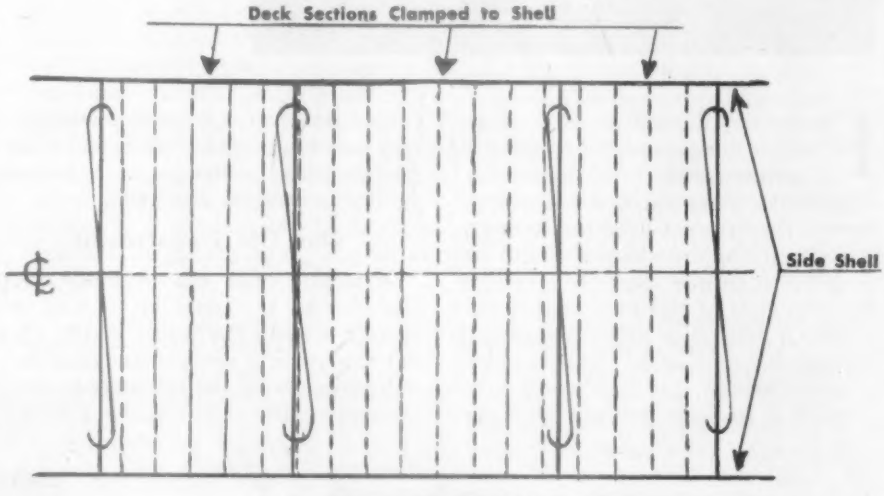
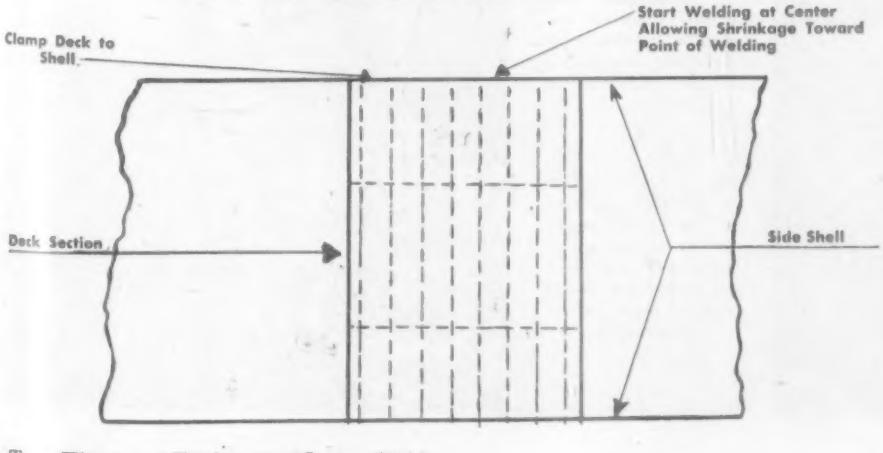



*Fig. 13—Erection of additional deck sections.*

*Fig. 12—Erection of first deck section. Plating butt welds made in subassembly are again omitted for simplicity.*



★ OPERATIONS

# A Modern Welding Department

**It didn't cost a fortune to provide a clean, light and well ventilated working area, but it paid big dividends.**

*By* **THOMAS R. HOUGH**
**Plant Manager, Cook Electric Co.**

*Fig. 1—Curtains keep the arc from the eyes of passers-by but often keep it from the welds, too.*

FEW PEOPLE realize how pleasant working conditions can be in a welding shop if an honest effort is made to make them so. Unfortunately, the "typical" shop of today is one which combines darkness and dirt with noise, fumes, and poor ventilation. In view of the disreputable state in which otherwise high-class organizations have allowed their welding shops to remain, it is little wonder that there is a tendency toward high personnel turnover. Clean, attractive and airy surroundings are particularly important today when so many women weldors are being employed.

### Our Old Department

Realizing that our welding shop was not all it should be, it was decided to review the entire set-up. Our old arc-welding department (comparable with similar departments in many manufacturing organizations) is pictured in Fig. 1. The weldors worked behind heavy curtains to safeguard their fellow employees from arc flashes. This was an important safety precaution, but inside the curtained booths wholesome employee working conditions were not prevalent. Good lighting effects were difficult to provide; ventilation and fume exhaustion were not all that could be desired; good supervision was impossible. In such surroundings, the best manufacturing results, of course, could not be obtained.

As is the case of many companies doing welding, this department at Cook, like Topsy, had "just growed." Insufficient attention had been given to layout and placement of welding equipment. In this, however, we were not at all unique. The set-up was more or less typical, we found, of plants where rapid growth has occurred due to the unprecedented demand for wartime products.

### Contemporary of Bell

Before describing in detail the steps taken to make over our whole welding department, it might be well to say a few words about our company and one of its major products. Cook

*Fig. 2 (left)—The interior of a typical arc-welding booth in the old set-up. It is rather cluttered up, and, to say the least, does not inspire its occupant to neat work.*

*Fig. 3 (right)—Pretty discouraging as a place to work! Yet atomic-hydrogen welding of high precision had its inception in these dismal surroundings.*

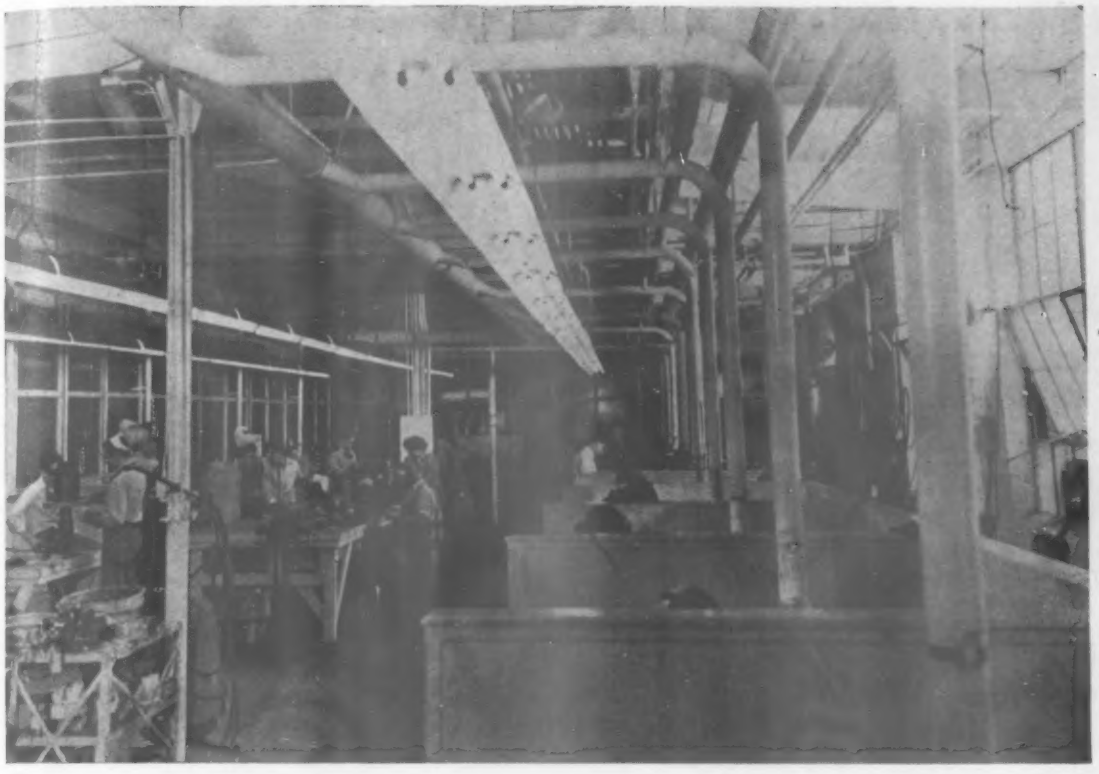


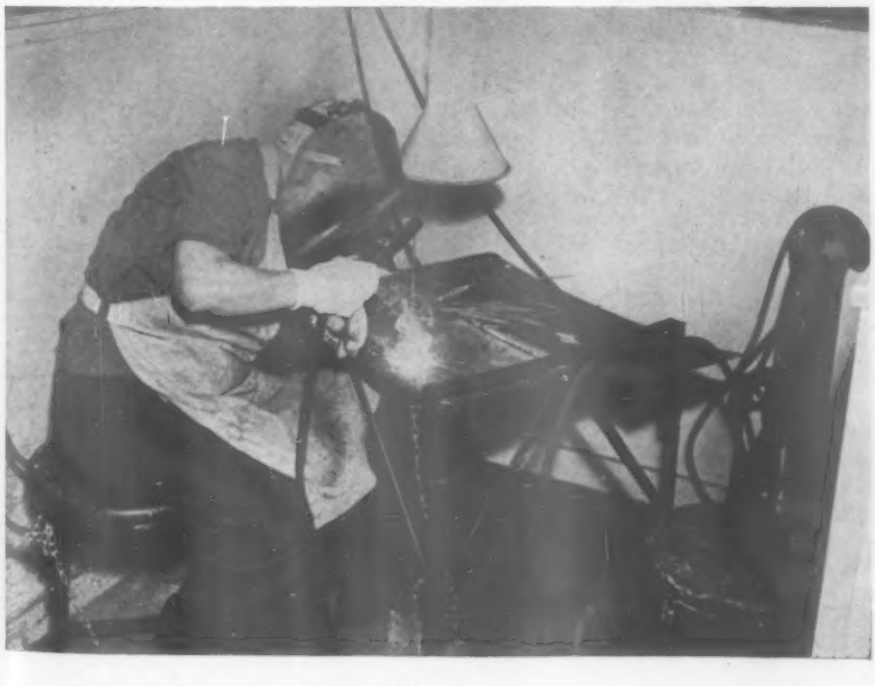
*Fig. 4—Light and airy, the remodeled welding department has little of the general appearance of the "typical" welding shop. Note the fluorescent lighting and the ventilating ducts.*

Electric Co. is one of the oldest manufacturers of telephone equipment—we began in 1879, just three years after Alexander Graham Bell had successfully demonstrated his first telephone. At this time, of course, welding was confined to the village blacksmith.

In recent years Cook Electric Co. has expanded its activities into the electrical field, specializing in the production of pressure-actuated switches, relays and similar equipment. During the course of our efforts to obtain superior products, we found that it would be necessary to develop a better bellows than could be obtained by use of the conventional seamless type. The result was the invention of the Cook "Spring-Life" bellows, having applications on equipment using electronic principles of control.

We had determined through research that the demands placed upon metal bellows in operation are quite similar to those upon a coil spring. These requirements could not be met by any bellows then available. The Cook solution to the problem was to devise a method of bellows fabrication which permitted the successful use of spring-tempered metal. This is the primary point of difference between Cook's "Spring-Life" metal bellows and those in competitive fields.

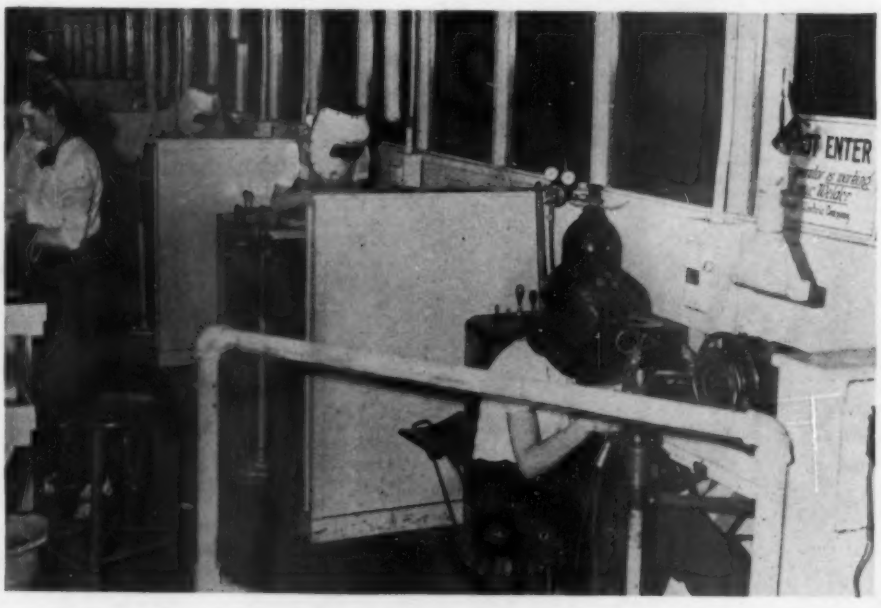
*Fig. 5—The low-walled booths give arc welders their proper share of light and facilitate the task of the welding foreman.*



### Any Size, Any Metal

This type of construction banished the days when design had to depend upon a standard type of application, mounting or size of bellows. It is now possible to build bellows of just the type of metal and size to fit any specific application. In contrast to the limitations put upon machinery used

*Fig. 6—The "dog-house" takes the welding generators and their resultant noise outside.*



in the fabrication and manufacture of seamless bellows, there is no limitation on the diameter or on the number of diaphragms that may be used in bellows of Cook design.

The simplicity of design of each diaphragm enables close control of the temper and thus the effectiveness of the metal during fabrication. It is, therefore, possible to make bellows of tinned phosphorous-bronze, copper, beryllium-copper, stainless steel, Monel, Inconel, nickel-silver and other alloys. The user is thus given a wide selection of metals to meet not only all ordinary corrosive conditions but also a wide variety of unusual conditions. For some applications, bellows have been made of sterling silver; stainless steels have even been gold-plated in order to meet special requirements.

As a result of our extensive research, we arrived at the fabrication of a highly satisfactory product. The impetus of war, which obviously stepped up the demand for bellows for various armament purposes, caused our production to be expanded in order to give other users the opportunity of incorporating these fabricated bellows in their equipment designs. Orders come to us for bellows made of many different metals and with diaphragms joined by various means such as soldering, brazing, arc and atomic-hydrogen welding. We thus had the opportunity of observing the results of these different methods of construction under various operating conditions.

### Back to the Welding Shop

Greater demands and the resulting increased production brought about a continued growth in the welding facilities and personnel. The department was by now somewhat out of hand. Inside the hot, stuffy canvas curtains (Fig. 2), were to be found: steam radiator lines which were excellent for hanging things on, a couple of welding generators to keep things noisy and an inadequate fume exhauster. That was just the arc-welding booth section. The real gem from the standpoint of make-shift was the corner in which a single weldor strove to carry out exacting atomic-hydrogen welding.

We use atomic-hydrogen welding to insure bellows which are free of porosity. This process renders it possible to provide complete bellows assemblies capable of retaining vacuums of .01 micron (.00001 mm) per hour. It speaks volumes for the skill of our atomic-hydrogen weldors that such a high degree of precision was attained under the difficult working conditions shown in Fig. 3. True, rejects were sometimes high, but that was seldom the fault of those doing the welding.

### How Different Today!

This somewhat undesirable result of the shop survey told us that something had to be done about the welding department—but quickly. We did it. The results are shown in Fig. 4, which pictures our welding department after a thorough but comparatively inexpensive remodeling job had been undertaken.

In the remodeled department, the arc and resistance-welding operations are carried out along one side (right of Fig. 4) while atomic-hydrogen welding and oxy-acetylene brazing are accomplished along the opposite wall. Two passageways and a line of test and inspection benches occupy the central portion of the department. All welding operations are inspected at these stations. The diaphragms are also carefully inspected after the internal welds are made and prior to welding the outer circumference of the bellows. Defective parts are thus caught early in production and eliminated before extensive welding has been done.

*Fig. 7 (above)—Atomic hydrogen welding is carried out in neat booths which contain only atomic-hydrogen welding equipment and guarantee freedom from annoyance by neighbors.*

*Fig. 8 (right)—Atomic-hydrogen welding of bellows has become a semi-automatic operation because of the fixtures used. A revolving jig holds the bellows while a torch fixture positions the torch.*

### More Candlepower

A high foot-candle rating of light is obtained from overhead fluorescent lighting fixtures. These run in three long parallel lines the entire length of the room. Three-dimensional painting is also used to aid visibility. Curtains have given way to paneled booths in which the arc weldors, too, can enjoy their full shares of light.

Each arc-welding booth is five feet square, and the wall panels extend upward from the floor for a distance of about four feet. This is sufficient to shield other workers from arc flashes, and yet the arc weldors are taken out of their former canvas-wall

caverns. The open arrangement has greatly reduced the work of the supervisor by making it easy for him to keep track of what is going on. Thus he can readily catch production errors and avoid much work spoilage.

These arc-welding booths contain only what is required to carry on successful welding operations. Fig. 5 shows one interior. There is a welding table, a couple of stools, a stand to hold the excess welding-lead cable, and—probably the most important item—an adjustable fume exhauster.

### No Welding Fumes

The fume-exhauster system rates a separate paragraph. The smoky, dusty atmosphere so long associated with arc-welding operations has been entirely eliminated. The individual collectors lead into a central duct (shown in Fig. 4) and are exhausted by a large suction fan having an air-moving capacity of 4,500 cfm. The fan is located in the shop ceiling and expels the contaminated air through the roof.

The reduction of shop noises has also contributed to more pleasant working conditions for all welding department employees. To accomplish this, we moved the arc-welding generators out of the building and housed them in the small lean-to or "doghouse" shown in Fig. 6. The welding generators are adjusted by remote control from the welding booths. This arrangement allows a weldor to regulate the current to suit individual needs *without leaving the booth* but eliminates all of the noise of the welding machine from the room.

### Atomic-Hydrogen Booths

The booths for atomic-hydrogen welding (Fig. 7) are on the opposite side of the central passageway and at the other end of the room from the arc-welding booths. Since the atomic-hydrogen welder is practically noiseless in operation, it is most conveniently located in the welding booth. The booths are also provided with fume exhausters. Though these are immediately available when required, they are rarely used because: (1) the flame is so delicate that air movement can draw it away from the metal, resulting in a defective weld, and (2) the atmospheric contamination from such a delicate flame is so slight that fume removal is rarely warranted.

The atomic-hydrogen welding operation has become semiautomatic because of the extensive use of jigs and fixtures in connection with this work. Since all welds are made on either the inner or outer circumferences of the bellows, welding can best be done in rotating fixtures such as shown in Fig. 8. This fixture is motor-driven through a speed reducer, making it possible to vary the speed of the rotation to obtain the desired circumferential speed for any particular diameter of bellows. The two diaphragms clamped in the fixture will thus pass under the atomic-hydrogen arc at the proper welding speed.

The atomic-hydrogen torch is mounted in a fixture which maintains the proper vertical height for good welding. It is only necessary for the operator to swing the torch into the welding position, and the arc will be automatically centered over the joint by the torchholding fixture. Satisfactory welds are the result. The details of both the torchholding fixture and the rotating fixture for the bellows may be seen in Fig. 8. In this picture, an inner circumferential seam of the bellows is being welded.

### Resistance Welding

The five spot welders across the aisle from the atomic-hydrogen booths were probably least affected by the drastic remodeling which we carried out in the welding department. These machines, however, were rearranged so that all of our spot-welding activities would be carried on in a particular part of the department, a section of which is shown in Fig. 9. The most unusual part of the set-up is the separate fume exhauster provided for each welding machine. Each of these fume exhausters is in turn tied into the central system previously described.

When the idea of dressing up the welding department was first suggested there were many skeptics who asked such questions as: "Will it be worthwhile?", "Work is being done; why upset things?" and similar comments. We know the answer now—the simple expedient of cleaning up our welding department has increased production by 50%. Employee morale is high because our employees (many of whom are women) have clean, light and well ventilated working quarters. Absenteeism is down for the same reason, and better company-employee relations have resulted because of the improved conditions.

***Fig. 9—Even the spot-welding machines are fitted with fume exhausters, which the employees fully appreciate.***

## Fashion Plate

*Courtesy, American Manganese Steel Div.*

***"The new girls in the welding department have sure stepped up our morale. It's the first time in 17 years that Steve's come to work with clean overalls an' his hair combed."***

**★ Part Two—Will plastics displace steel and non-ferrous materials in the postwar era? What will be the effects on industry? On welding? Who will use welding after the war? The answers will be found in this article.**

*By* **T. B. JEFFERSON**

# Shadows of the Future

*In a two-part article, the editor of* THE WELDING ENGINEER *discusses postwar possibilities as they affect the welding industry. Last month Mr. Jefferson gave his impressions of the basic problems which will confront industry in general and welding in particular in the postwar world. The present installment takes up the question of postwar materials and their effects and the important question of postwar welding uses.*

MANY people have predicted with great enthusiasm that we will be living in the plastic age when peace again settles over the world. Production figures and general knowledge of the plastics industry, however, do not indicate this. In 1943, plastics represented only about 0.2 of 1% of the basic metallic and non-metallic materials produced, something like 200,000 tons.

### No Plastic Tops

Despite plastic promises and plastic thoughts, we will undoubtedly continue in the "alloy age" for many years. We will not have those teardrop automobiles with plastic tops until producers can develop facilities for molding plastic forms in large shapes. Even then we will not have such cars unless many of our states change their present laws.

People who become hypnotized at the mere mention of "plastics" and can see only a brightly colored world of rounded edged objects can be rudely awakened. Tell the plastic enthusiast to go home and gather together all of the plastic objects he owns. He will probably find a fountain pen, a pan lid handle, a few lamp plugs, maybe a radio case, an ash tray or two . . . in few cases will the total be at all impressive.

Plastics can be used as a molding to complement steel in many industries, but because of the lack of surface hardness and ductility it is very unlikely that any plastic will be used for structural purposes. And it is a fairly safe guess that the more widespread use of plastics will probably result in the sale of as much steel as is replaced. For this reason, we need evince no particular concern regarding the welding of plastics in the postwar era. Some of our prewar liquid solders and cements having a cellulose base will probably be suitable for the job.

As the plastic field grows, there will doubtless be attempts to weld these materials by high-frequency heat and pressure applications. The success of this type of welding will depend largely upon the flash point and melting characteristics of the material involved. Plastics of the thermo-setting type can never be welded, for these materials cannot be returned to the plastic state after they have once set. The application of heat merely causes them to burn or char.

### It's Still Steel

Those who vision a postwar world in which steel, aluminum, magnesium, copper and brass, lead, zinc and the non-metallics will strive haphazardly to capture markets are due for a let down. Steel will continue to be the basic material of our fabricating processes after the war. There will be competition, of course, but from all indications it will be of an orderly nature, with each material seeking its natural outlets. Nearly every producer of materials, whether of steel, non-ferrous metals, plastics, glass or plywood, has been studying the outlets for his products with a great deal of precaution in order to prevent costly misapplications.

This country, on the basis of 1944 production estimates, is capable of producing approximately 112,000,000 tons of basic metallics and non-metallics. Of this amount about 85%, around 96,000,000 tons, will be steel. Aluminum and magnesium together will only represent about 1.3% or approximately 1,500,000 tons. We might break the latter figure down still further by estimating aluminum production at 1,200,000 tons and 300,000 tons for magnesium. That's about it, I think.

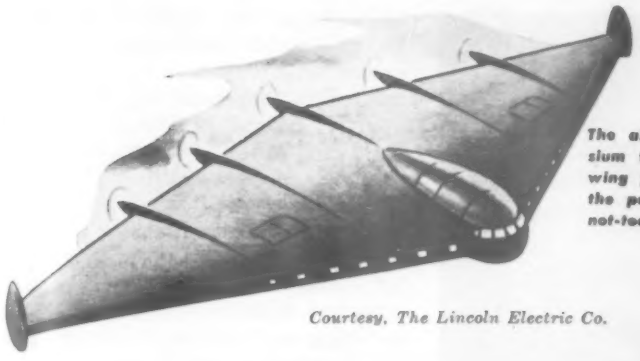
In view of the above, it does not appear likely that the light metals will be extremely important factors in our immediate postwar production capacity, even when you consider their advantages of weight saving, etc. Naturally, aluminum and magnesium will compete with steel to some extent, but they will not become as serious competitors as some of the light metal boosters lead us to believe. Speaking generally, it seems to me that the light metals will have much more effect on the market for other non-ferrous materials than on the steel market.

### Light Metal Welding

The problems of aluminum welding and fabrication, though difficult, have been fairly well licked. This isn't yet true of magnesium, despite recent development of helium-and-argon-shielded arc-welding methods. The major headache in the fabrication of magnesium remains in its flashy burning qualities. Though the featherweight metal can now be readily welded, difficulties are frequently encountered in machining the welded pieces.

It would seem reasonable to assume that the light metals will make inroads in the building of hardware and gadgets as well as transportation equipment fixtures which are now largely made of zinc die castings, copper and brass. These applications are not likely to affect or bother the welding industry.

"If not plastics or light metals, then what about die castings and pressure forgings?" again ask the new-and-different world advocates. The answer is again discouraging. Yes, there will be die castings, many more than ever before, but with the same old limitations. Lead and zinc together represent only 2,000,000



**The all-welded magnesium flying wing (all-wing plane) is one of the possibilities of the not-too-distant future.**

*Courtesy, The Lincoln Electric Co.*

*Designed by Robert E. Bingman, Detroit engineer and industrial designer, for Bundy Tubing Co.*

**Judicious use of welding will help to streamline the street traffic of tomorrow.**

tons—less than 2%—of our basic materials for 1944, and this production is at a peak because of wartime demands. These figures are not of the magnitude that will scare the welding industry.

### Glass Welding

Glass is a different matter, fanciful as it may seem to think of it as competing with steel. In 1944, however, glass will be the second largest basic material produced in this country. More than 6,000,000 tons of it will be made.

The increased use of glass in various structural fields, in piping systems and similar installations may lead to possible applications of glass welding in the not-too-distant future. In view of its widespread uses, there exists a likelihood that gas welding or resistance welding or processes employing high-frequency induction heating (or any other form of heat that may be used with non-conductive material) may be adapted to weld glass.

If your imagination boggles at this, simply consider that glass welding is being performed every day in the intricate glass testing apparatus that is employed in big industrial laboratories. Glass pieces are simply heated at the ends, then pressed together to form intricate fittings, lengthy tubings or whatever else is desired. So far glass welding is confined largely to flame heat, but there is no reason why another pressure welding process such as resistance welding could not be used. When glass is heated to a sufficiently high temperature, it becomes an excellent conductor of electricity. Perhaps even arc welding of glass may eventually become possible.

### Postwar Welding Users

In all probability, there will be three types of users of welding in the postwar world; namely, (1) former users, (2) expanded users, (3) new users.

Those who used welding before the war will naturally continue to use it afterwards. The big users in this category are shipbuilders, tank and pressure vessel fabricators, contractors and a miscellaneous group of steel product manufacturers.

The expanded users will include those who used welding in a small way before the war but will greatly expand its use afterwards. These are the manufacturers of automobiles, airplanes and agricultural equipment.

The third group will be comprised of organizations first introduced to welding through their war contracts. Such manufacturers, having learned of the many advantages presented by this superior fabrication process, will naturally be inclined to favor it in their postwar fabrication. Why, indeed, should they revert to the slower, more costly methods of fabrication which they had previously used? Among organizations of this group will be manufacturers of household appliances, office equipment, shop equipment and other light metal products.

### Welded Automobiles

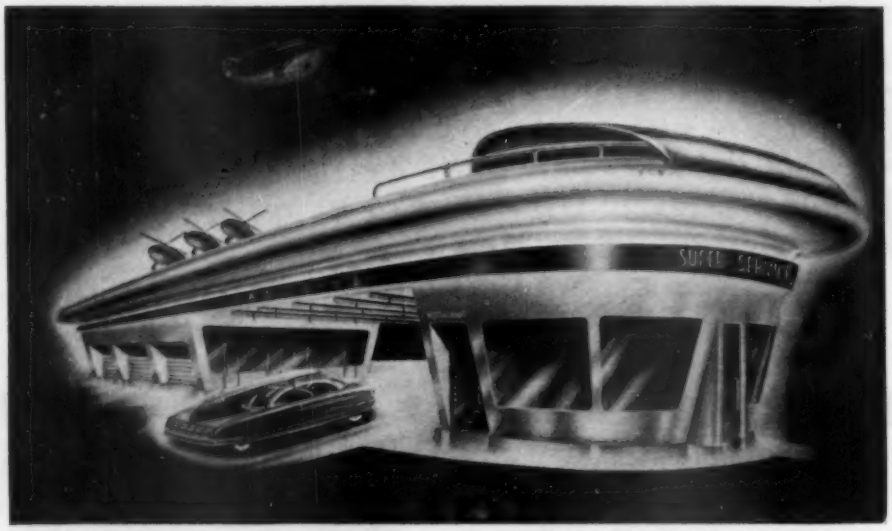
The automobile industry will undoubtedly be one of the big users of welding in the postwar era. Even conservative planners are forecasting the coming of 6,500,000-car years, and a number of plants have already mapped out production schedules that are 50% beyond the highest level attained in the past. For at least a few years the demands for automobiles will be extremely high. It will require a full year of production to bring the number of cars in service up to the 31,000,000 of the 1941 level. There are optimists who believe that the country can handle as many as 60,000,000 vehicles.

The purchaser of the postwar automobile will find that welding is helping to give him a better product at reduced cost. It would not be surprising if we should find the postwar car is almost entirely devoid of rivets. Spot welding and arc welding will replace all but a few of the rivets in the frame.

### Aviation

Another field that will be wide awake to the postwar possibilities of welding is aviation. Improvements in aircraft and aircraft engines assure that a large part of the world's long-distance passenger and express traffic will go by air after the war. (Heavy freight and local passenger traffic will continue to be handled by train, truck and boat.) Much of this expansion will depend upon the attitudes of the various governments involved, but if aircraft is given the "go-ahead," welding will undoubtedly benefit.

Only a small proportion of our thousands of warplanes are adaptable to peacetime commercial flying. Most fighter planes have been built for extremely high-speed combat performance at the expense of load-carrying capacity, comfort and fuel efficiency; bombers for high bomb-load capacity plus heavy armament plus high speed. In peacetime, different characteristics, especially fuel economy, will be required. It seems likely that an entirely new type of transport and cargo plane will be built after the war and built in large quantities. Here, too, welding will be used extensively for economical manufacturing. With thousands of pilots returning from war, there will be a need for small planes: estimates range from 25,000 to 250,000 a year.



Courtesy, Doan Aluminum & Brass Corp.

***Welding will provide a means for the mass production of prefabricated buildings such as this filling station. It will also give greater strength to the motor car and helicopter.***

### Steel Planes Coming

From observations of experimental activities, it appears that we are due for some surprises so far as the aircraft of the future is concerned. Experiments on aircraft skins have been carried out using both stainless steel sheets and flat rolled materials of low-alloy, high-tensile steels. So far, however, only stainless steel has been actually used (see "Flying Conestogas" on page 52 in this issue), but the chances are that we will be building other types of steel airplanes in the not-too-distant future.

Aluminum and magnesium naturally will play an important part as postwar aircraft metals. There will be an expanded use of resistance welding in this field, particularly in our larger planes. Resistance welding has proved satisfactory, and there is no reason why expensive riveting operations should be carried on when spot and seam welding are available. Government regulations will be eased somewhat, making possible broader uses of welding.

One of the largest pent-up demands after the war will be for refrigerators, ranges, washing machines and other household appliances. It is estimated that in the next seven years—between now and 1950—over 26,000,000 refrigerators will be required to take care of the consumers' needs. During this same period, we should have nearly 18,000,000 kitchen ranges to take care of replacements as well as 19,000,000 washing machines. All of these are potentially welded products and will represent a tremendous market for the welding industry.

The construction field will also be of vital interest to the welding industry. Relaxation of wartime restrictions on steel will find the whole construction industry more interested than ever in the use of welded sections. It is to be hoped that leading producers of structural steel will start soon to study designing of shapes especially suited for use in welded structures. Engineers might produce many new such shapes.

There is little likelihood that steel will be replaced by the lighter metals, particularly in structural frame or long spanned units. There is a possibility, however, that the lighter metals will find use in welded cranes and other mobile equipment. Corrosion-resistant alloys having a permanent finish are sure to assume a strong lead for installations exposed to weathering or processing vapors. In any event, welding will be the most popular of the metal-joining processes employed in the construction field.

There is a likelihood that much of our postwar construction will be in the form of public works, bridges, elevated highways, ramps where highways pass through cities, housing projects to build some of the 9,000,000 or so homes that are now needed in this country. There is also some likelihood of huge new power projects of the Boulder and Grand Coulee dam type. These various public work projects will be carried out in an effort to minimize the postwar effects of cuts in Government spending, cancellation of war contracts, demobilization of the armed forces and discharge of war plant workers. Welding will undoubtedly play an important part in their construction.

### Prefabricated Homes

An interesting application of welding in the construction field will be found in the prefabricated home. Before we see many of these, (1) labor must coöperate with manufacturers and contractors to remove present restrictions against the erection of factory-built houses and (2) archaic and shortsighted municipal building codes will have to be amended to meet realities.

The all-welded steel home will present many advantages. It will be fireproof, vermin-proof and practically everlasting. Its materialization, however, depends upon the solution of one gigantic problem: women's wants.

The prefabricated home can only be built at low cost if it can be built on a production basis. To do a production job, however, it is necessary that you build hundreds of homes alike. And as soon as an average woman sees the picture or plan, she will want the sink on the other side of the kitchen, the bathroom on the opposite side of the house, more closets, etc. Since no two women have the same ideas as to where these various conveniences should be located, each house turns out to be a custom-built job if the customer is to be thoroughly satisfied. But prefabricated houses will have to be built on an "as-is" basis to be satisfactory from a manufacturing standpoint. No one has yet figured out a way to reconcile the mass-production home with women's individual wants.

### Machine Tools

Many machine tools built for war purposes will be of no use in the postwar era, and many special-purpose tools will be required for peacetime production. This will undoubtedly keep the machine tool industry running at a fair rate of operation for several years at least.

Builders of machine tools have extensively adopted welded construction for their products. This was somewhat of an emergency measure during the war because of crowded foundry conditions, but the advantages of welding were learned and I can see no reason why tool makers should revert to cast parts for their future tools. This particular welding market will not be nearly as great as in the war era, however, because of the greatly reduced demands for machine tools.

Because of the rehabilitation work that will be necessary the world over, there will be heavy demands for earth-moving equipment and hand tools. There will be a lesser demand for cranes, hoists, conveyors and various electrical equipment.

Welding has proved itself to be the only satisfactory means of building earth-moving equipment sufficiently rugged to meet the needs of construction companies. A significant develop-

ment in this field is a heavy-duty, twin-engine wheeled tractor 36 feet long. This unit and its scraper weigh 34,000 lb and can handle 60 cubic yards of material at one time. Such equipment must be designed for welded construction if long life is to be expected from it.

### Pipe Lines

The oil and gas industry will continue to use welding in the future as in the past. There is a feeling among contractors that the building of the wartime pipe lines, the Big Inch and the Little Inch, will encourage further welded pipe construction after the war. The very least expected is for pipe line construction to retain its normal rate of growth, which for the last 20 years has averaged about 4,000 miles a year, including main and feeder lines.

Extensive exploration and drilling operations will undoubtedly be undertaken after the war in an attempt to replenish our war-depleted oil resources. Considerable welding will be used both for the construction of oil field equipment and for its maintenance. Those in the oil fields have always been big users of welding and hard-facing, and it is certain that they will continue to make advantageous use of these processes.

The oil industry is subject to many possible changes because of continued experimentation at heretofore unexplored temperatures and pressures. The disintegration and reforming of petroleum hydrocarbons, for example, is carrying the oil chemist and engineer into increasingly higher temperatures and pressures. It has been welded equipment that has made such operations possible. Thus the use of welding is sure to be expanded in refineries. Better knowledge of the metallurgy of high-chromium and other high-temperature, high-strength steels will permit a more widespread use of welding in the building of pressure vessels, cracking towers and other refinery items.

### Shipbuilding

Shipbuilding, for the past several years the welding industry's Number One customer, will slump after the war. Yet it is improbable that it will ever slump as low as prewar levels. In 1936, for instance, there were only 10 shipyards with 46 ways capable of building ocean-going ships 400 ft long. Today the Maritime Commission alone has 70 yards with more than 500 ways. Prewar employment in the shipbuilding industry was about 200,000. Today it is estimated that 1,500,000 or more are employed, and additional workers are needed.

The end of the war will inevitably mean the extensive liquidation of shipbuilding facilities and, to a lesser extent, of ship repairing. Nevertheless, passenger liners will be built and new oil tankers will be required. Additional Navy construction will also be needed if America is to do her share in policing the postwar world. In view of these activities, many shipyards will continue to operate, though to a far lesser degree. Welding, of course, will continue to be used for both shipbuilding and ship repairing as long as any work at all is being done in either branch.

### Other Industries

What has been said about these few industries might be continued on down the scale for all industries. The railroads with five billion dollars to spend will naturally turn to welding for stronger and lighter equipment which will give them an increased load capacity at lower operating costs. The welded locomotive boiler, an experiment today, will be a reality in our postwar world.

We will see a drastic change in furniture construction. The prewar trend to metal furniture will be renewed once production restrictions on materials are lifted. Furniture built entirely of wood will be replaced by welded tubular furniture, which will not only be more durable but less expensive to produce.

The rock and gravel, brick and clay and other heavy industries will turn more and more to welding, both as a means of fabricating and of maintaining their equipment. In short, wherever there is industrial activity there will be welding.

Countless evidences are available on every hand of the contributions made by welding to the efficiency and economy of our industrial operations and to the development of new, more effective equipment and commodities. The modern airplane and the modern ship are typical examples.

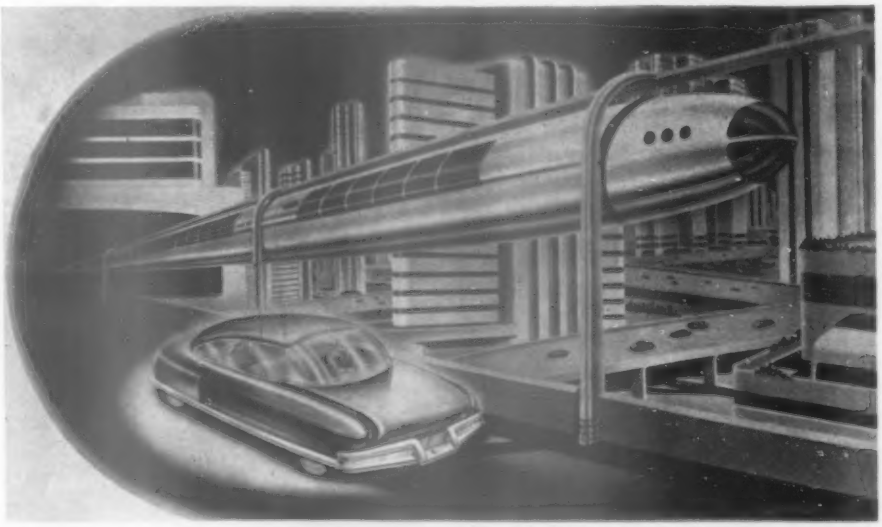
The old airplane wing with its multitude of exposed rivet heads has been replaced by smooth welded surfaces, offering less air resistance and greatly increased strength. In other parts of the plane, the introduction of light metal alloys has been coincidental with the advance in welding research.

The rate at which our nation is now building ships is ample evidence of the saving in time that was accomplished by eliminating the tremendous job of riveting the multitude of plates and incidental structures that go into a modern ship.

### New Developments

Future progress in welding can also be expected to contribute to new enterprises. All research has been tremendously accelerated by the urgency and uncertainty of our war needs. On this score, welding research has by no means been neglected. It seems quite obvious that continued study and research in welding and metallurgy give promise of a development beyond any so far imagined.

The welding torch, the arc and the cutting torch are now being devoted almost exclusively (if sometimes indirectly) to the business of war. When they are eventually permitted their full power in reconversion to peacetime production, welding applications will have greatly widened in scope and general usefulness. It can be safely said that for every welding use today there will be at least a half dozen uses in the postwar world.



*Courtesy, Bohn Aluminum & Brass Corp.*

***Steels, light metals and plastics will all play their parts in building the World of Tomorrow. Even office buildings may be streamlined for pleasing appearance.***

# Arc Welding Cast Iron

**Experience has demonstrated that no single type of electrode is "best" for cast iron welding. Different types of electrodes and procedures are required for different jobs. Helpful hints on when to use what are given here.**

*By* **CHARLES CARTER**

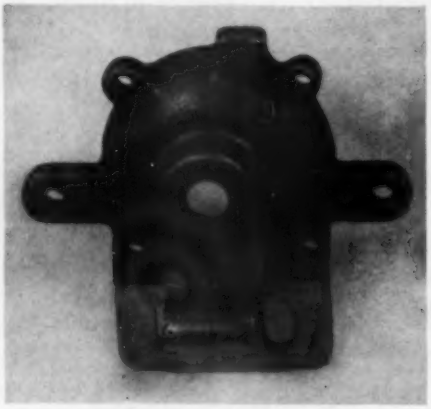


*Fig. 1—Several hundred of these 2 lb castings had to have a larger lug for an additional screw hole.*

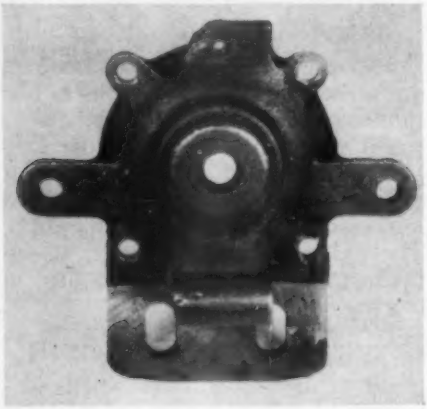


*Fig. 2—How the problem of Fig. 1 was solved by arc welding (top lug). A copper-sheathed, nickel-core electrode was used to add the metal.*

Among the earliest applications of the welding arc were a few special procedures for welding cast iron which have continued in use to the present day. Machinable arc welds in cast iron were first made back in 1917 when salvage contractors were employed to recondition some interned German merchant ships. For this purpose, a Monel electrode was employed with fairly satisfactory results. It is not surprising, therefore, that the earliest commercial electrode developed for cast iron welding should be of Monel.

### Other Electrodes

Attempts were made, of course, to weld cast iron with mild steel and cast iron electrodes. These welds were not machinable because of the hard white iron produced at the fusion line. Not until comparatively recent times was it learned that the hardness of the fusion line can be minimized by proper control of the cooling rate. By following recommended procedures, satisfactory welds on gray cast iron can now be made with cast iron electrodes; however, welds made with mild steel electrodes or with austenitic stainless steel electrodes are not readily machinable.

The early developments in cast iron welding were along the line of using non-ferrous weld metals which would not produce the hard, unmachinable zone. Monel has already been mentioned. Another electrode contained a nickel core sheathed with copper and steel, while still another type had a pure copper core with a steel sheath. Experience with all of these various methods has established their limitations as well as their possibilities.

### No Universal Method

The industry has at last learned that there is no arc-welding panacea for iron castings, no single procedure that will yield a universally acceptable result. This fact should be self-evident, because of the great variety of iron castings and their uses, but unfortunately it is often disregarded and misleading categorical statements are made.

The object of this present review of recently developed procedures for the metal-arc welding of cast iron is to direct attention to the characteristic results which may be achieved with each procedure. The superiority of any one process for any given application can then be determined by the deposit characteristics which are most desired in that case.

Arc welding is naturally attractive to makers and users of iron castings because of its economy and because the localization of the welding heat avoids much undesirable thermal effect on the work. However, the presence of free graphite in the parent metal always has to be taken into account since any process which involves heating and sudden chilling encourages the formation of hard carbides.

A basic factor in the selection of an electrode for welding cast iron is the hardness of the deposit and of the fusion zone; both of these will affect the machinability of the welded piece.

Another basic factor to be considered is the reason for welding. Is it to repair a fracture, to build up a worn part, to correct a foundry defect or to accomplish a change of design without making a new pattern and a new casting? Different methods and electrodes will be used for each. The choice of method or of electrode material may also be influenced by preferences as to color of deposit; for example, it may be desirable to match the parent metal closely.

How far the range of procedures and of electrode materials for the welding of cast iron has been developed is indicated in a manual recently published by C. E. Phillips & Company, Detroit. This describes several very different types of electrodes developed for cast iron welding. One is of nickel wire enclosed in a copper sheath and flux coated. A second is a nickel-copper alloy wire enclosed in a mild steel sheath and flux coated. There is also a special

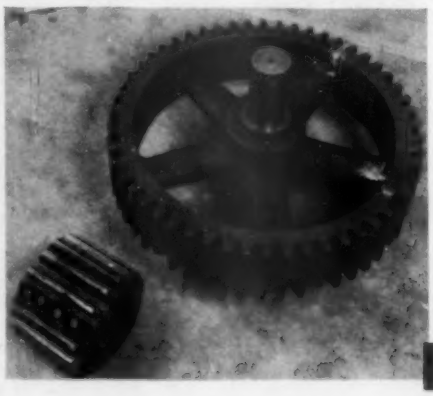


*Fig. 3—Gear and pinion as prepared for repair with steel-sheathed, copper-core electrode. Note the studding in the pinion.*

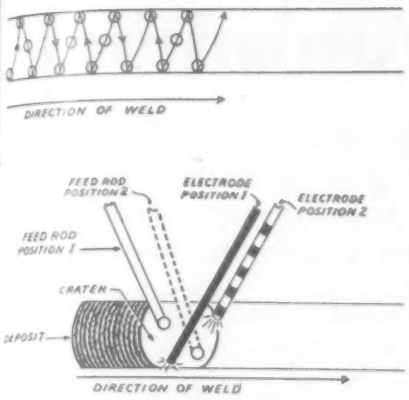



*Fig. 4—Schematic diagrams of proper procedure for use of a silicon-bronze filler rod with one of the various fabricated electrodes for cast iron welding.*

cast iron rod, flux coated. These differently composed electrodes are all in current use; the question of which to choose will depend entirely upon what deposit characteristics are wanted.

### Copper-Sheathed Nickel

A distinguishing characteristic of the copper-sheathed, nickel-core electrode is the complete machinability of its deposit, including the line of fusion. The deposit is also of the color of cast iron, which is very important in many instances. This electrode can be applied by either a-c or d-c welding. With d-c machines, the electrode is positive (reverse polarity). A moderate preheat (not in excess of 300 F) is recommended in order to prevent too rapid solidification of the metal at the line of fusion. A multiple-bead application instead of weaving is used to minimize alloying action; that is, the best quality of deposit is secured by avoiding any more penetration than is necessary.

The nickel-core electrode was used to increase the size of one lug on a small casting (Fig. 1) weighing less than two pounds. The weight of metal salvaged was not impressive, but the time saving was. Several hundred of these castings had been through an extensive series of machining operations when a design change made it necessary to have a connecting screw in a location where there was no metal to receive it. A very small deposit solved this problem. As shown in Fig. 2, the additional hole was drilled and tapped directly through the line of fusion.

For applications where it is desirable to have the deposit match the color of the casting and where machinability at the line of fusion is not essential, the electrode of nickel-copper alloy sheathed in mild steel is widely used. A very popular application for this electrode is in the filling of blowholes. The electrode is used with straight polarity, d-c, and can also be applied by a-c welding. For best results, particular care must be taken to complete the weld with the lowest possible amount of heat and to avoid unnecessary stops and starts.

### Steel-Sheathed Copper

The third composite electrode, copper with a mild steel sheath, yields a copper-colored deposit which is quite ductile and shock-resistant. This electrode, however, is not recommended for applications where machinability of the deposit is essential. It can be used in all positions with either straight polarity, d-c, or with a-c machines. The casting must first be thoroughly cleaned by mechanical means, and particular attention needs to be given to keeping the heat at a minimum because the low electrical resistance of the copper core will tend to build up the current.

Fig. 3 shows a gear and pinion as prepared for repair with the copper-core type of electrode. In preparing this job, steel studs were inserted to prevent shrinkage forces from distorting adjoining segments of the gears as the deposit cooled. The studding is particularly well shown in the illustration of the pinion at lower left.

### Bronze Filler Rods

When the weld is of appreciable depth, requiring several layers to be deposited, a special technique has been developed. This utilizes one of the previously mentioned coated fabricated electrodes in combination with a filler rod of silicon bronze. The operator uses one hand to maintain the arc with the special electrode and feeds the bronze wire into the crater with the other hand. The first layer is always made with the electrode alone, the silicon bronze not being added until subsequent layers.

The filler rod is held close to the arc, and is added by intermittently bringing its end into contact with the crater behind the electrode. Care has to be taken so that the feed rod will not make contact with the electrode. Fig. 4 shows the principles of this manipulation schematically.

Fig. 5 shows an 800 lb flywheel which was repaired by the filler bronze method. The repair was made with 20 lb of electrodes and 5 lb of silicon bronze in 9 hr welding time. Twenty inches of welding were done on the 2 in. thick section of the wheel. The hub was not welded, but its 13 in. diameter and 9 in. thickness had to be taken into account. This large weight of metal was immediately adjacent to the welded section and so exerted a rapid chilling effect.

### Cast Iron Electrodes

For obtaining a truly homogeneous arc weld in cast iron, a flux-coated cast iron electrode is used. The deposit is described as a fine-grade cast iron which is machinable when properly applied. It is for reverse polarity, d-c, application only. The recommended procedure involves preheating of the work, particularly at the edges which must be kept at white heat during deposition. The arc should also be manipulated so that the weld area will remain at white heat for approximately half a minute after the deposit has been made. For this reason, the current settings are always as high as the mass of the work will permit.

Because of the large amount of heat introduced into the work with the above procedure, it is necessary to take precautions against contraction effects. Precautions similar to flame-welding practice should be observed.

The range of applications for cast iron welding is obviously much more varied than can be indicated by these few examples. Practically all of the requirements for arc welding cast iron in the foundry, machine shop and repair shop, however, can be met by one or more of these specially developed electrodes.

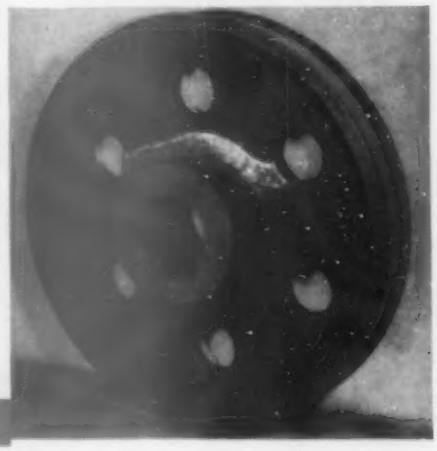


*Fig. 5—This 800 lb flywheel was repaired by depositing 20 in. of weld metal and filler bronze in a section of 2 in. thickness. The chilling effect of the large 9 in. thick hub had to be carefully estimated.*

★ PRODUCTION

# Saving Dollars for Foundries

**Machine flame-cutting greatly reduces grinding in the removal of risers from castings. So smooth are many cuts that no grinding at all is necessary. Another advantage is that there are no gouges to be filled in.**

*By* **GEORGE BELLEW**
Foundry Specialist, Air Reduction Sales Co.

*Fig. 1 — Motorized turntable for machine flame-cutting in order to remove risers from circular casting.*

◆

AS ANY foundryman knows, the removal of risers presents a constant problem both from an operational angle and from the standpoint of cost. One answer to the problem is to use flame-cutting machines instead of hand torches.

### Machine Advantages

The machine makes a closer marginal cut, leaving only the barest minimum of metal to be ground off. Thus the grinding operation can be reduced by at least 50%—in numerous instances by as high as 75 to 90%.

Unlike hand cutting, machine gas-cutting avoids making gouges in the surface of the casting. In this way much valuable time is saved since gouges must be filled with weld metal and ground flush. Also the factor of operator fatigue is eliminated, resulting in a more consistently high record of production efficiency and quality of output.

*Fig. 2—Clutch plate casting with risers removed. Note the smoothness of the cuts.*

### Clutch Castings Cleaned

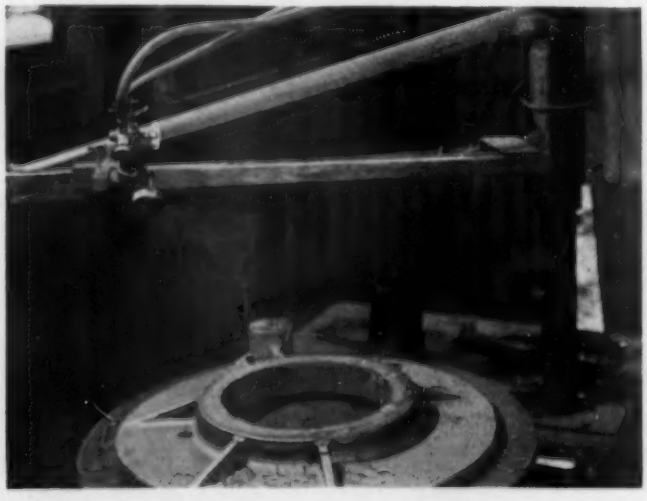
The accompanying pictures show a set-up developed by the American Steel Castings Co. to cut risers from circular castings. In Fig. 1, a woman operator is in the process of cutting risers from a clutch-plate casting. The casting is placed on a turntable which is rotated by a variable-speed motor. The cutting torch is mounted on an adjustable cantilever arm at an angle of 45 degrees. The arm can be swung in or out and the torch can be adjusted either up or down. On the particular job, the speed of cutting is 16 in. per minute, and the operator can handle between 50 and 60 castings in an 8-hr day. A small power-driven hoist is employed to lift the casting to the turntable.

In Fig. 2, the same casting is shown upon completion of the riser-cutting operation. By employing machine cutting, it was possible in this case to eliminate all grinding as the "as-cut" castings were immediately ready for finish machining. The importance of this is obvious, considering the high cost of grinding wheels.

### A Vertical Cut

Fig. 3 shows the same machine set-up as arranged for making a vertical cut. The casting is here mounted in a fixed jig on the turntable. Because of the thickness of the casting, the speed was reduced to 12 in. per minute; even so, it was possible for the operator to cut 60 to 70 risers per 8-hr day.

*Fig. 3—Mechanical set-up arranged for making a vertical cut.*



# Welded Drums on the Spot

**On the spot spot-welding is something new to come out of this war. Complex though it is, the impedimenta of the modern army can hardly be expected to include cumbersome equipment for resistance-welding operations. But it does.**

*By* **FRED B. BARTON***

*Above: Seam welding the longitudinal joint on a steel container. The Army uses local labor wherever possible.*

◆

shops in every theater of this world-wide war. These particular pictures happen to have been taken in the Middle East, but the Army's dependence on pure drinking water and clean high octane fuel is universal.

*Below: Circumferential seam welding is used to stitch in the top and bottom heads of these drums.*

AN ARMY still travels on its belly —just as Napoleon said—but in desert countries the water an army drinks is even more important than the food it eats. And in today's mechanized warfare you need thousands—hundreds of thousands—of containers. Drums and barrels for water: drinking, handwashing, dishwashing (boiling-hot dishwater discourages the germs of dysentery) and for thirsty truck radiators. Drums for gasoline—needed by trucks and airplanes and tractors and bulldozers and jeeps.

### Portable Factories

Little wonder, then, that the United States Army is prepared to set up a container factory almost anywhere, using either GI's or native labor plus whatever type of welding is suited to local conditions. If electric current is available, the job may best be done by using the mass-production methods of resistance welding. The advantages of quick, leakproof joints made with unskilled labor are obvious.

At one Army factory "somewhere in the Middle East" you can see flat steel sheets being cut to length, corrugated, shaped round and seam welded longitudinally into steel drums of the desired size. The ends are likewise stitched into place by circumferential seam welding. Spot-welding machines are also employed in the construction of these steel drums.

### Natives Learn Welding

As a gesture towards building international friendship, native labor is employed wherever possible. The natives learn quickly, and they work hard; if they have any weakness it is that they love to have their pictures taken. It is practically impossible to take a picture in any workshop hereabouts without every native workman smiling straight into the camera.

Ideally, any such installation is located on tidewater, where the heavy sheet steel can be unloaded, made into barrels and drums and filled with the necessary liquid close at hand. The Army is prepared to set up such

* War Correspondent Barton sent this report on welding operations in the Middle East to The Lincoln Electric Co., through whose courtesy this story is printed.

*Spot welding also helps to make steel water containers, but darned if we can figure out what this workman is doing.*

# Flying CONESTOGAS

**Welded stainless steel replaces riveted aluminum alloy sheets on new Navy cargo plane built by Budd Mfg. Co. This plane has a high ratio of payload to total weight: payload is 30.8% of the weight of plane and full load.**

*This is the Conestoga, new Navy cargo plane of welded stainless steel construction.*

KNOWN officially as the "Conestoga" in tribute to the famous wagon of pioneer days, a new air cargo plane has been put into full scale production by the Edward G. Budd Manufacturing Co. in its new plant near Bustleton on the outskirts of Philadelphia. This is a brand-new type of cargo carrier which utilizes welded stainless steel instead of riveted aluminum alloy sheets.

Though this is the first time that stainless steel has been used on any considerable scale in the manufacture of military and commercial aircraft, it is not the first airplane of welded stainless steel. *That* was created by the Budd organization as far back as 1931 and has been on display for the last eight years in front of Franklin Institute, Philadelphia, after hundreds of hours of successful flights.

### High Payload Ratio

The effective way in which stainless steel has been used in the design of the newest Budd plane is shown by the unusually high ratio of payload to total weight. Of a total weight of plane and full load of 33,800 lb, 10,400 lb represent the weight of the cargo.

The Conestoga is a two-engine transport 68 ft long. It has a wing spread of 100 ft and is capable of transporting its 10,400 lb cargo better than 600 miles at a cruising speed of 165 mph. The maximum range with available fuel tankage is about 1,700 miles, but this can be stepped up to as high as 3,500 miles with auxiliary fuel tanks.

Each of the 14-cylinder radial air-cooled engines delivers 1,200 hp for take-off and has a normal rating of 1,050 hp. Tests demonstrated that the plane in normal operation can lift its 10,400 lb payload off the landing strip in a run of only 920 ft.

### A Flying Box Car

In creating this flying box car, the design engineers centered their efforts on the twofold problem of providing an economical cargo carrier for flights of moderate length and a plane that could be loaded and unloaded with the utmost ease and speed. Both of these requirements have been amply met.

The cargo compartment measures 25 ft long, 8 ft wide and 8 ft high, and it is wholly unobstructed by structural members. A ramp to facilitate loading and discharge or a loading platform level with the platform of a truck may be formed by lowering the large cargo hatch in the underbody. The two large clearance doors back of this hatch may be lifted out of the way to provide the necessary headroom to utilize the 8 ft square cross-section of the cargo compartment.

The upward sweep of the plane's afterbody provides a large clearance below the fuselage and back of the ramp, allowing trucks to be moved close to the fuselage to pick up or discharge shipments. A specially designed cargo hoist is fitted above the loading ramp, and a manually operated winch is mounted on the forward end of the cargo compartment. Thus large, heavy pieces of freight, machinery, motor transport, etc., can be readily loaded. Both an ambulance and a jeep can be rolled in at the same time and still leave considerable space for the stowage of other cargo.

### Improved Wing Attachment

The unusually large cargo space is made possible through a unique design for the attachment of the wings to the fuselage. Instead of passing through the fuselage in conventional fashion, the wings are attached to five special side frames joined across the body by shallow but rigid transverse members. This provides headroom of 8 ft—2½ ft more than is possible with the conventional structure.

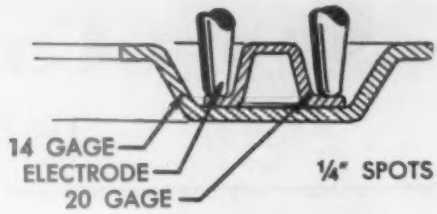
Primarily a cargo carrier, the Conestoga can readily be converted to either troop transport or to aerial ambulance use. Doors in opposite sides of the fuselage permit the launching of paratroops from both sides simultaneously; provision is also made for the discharge of paratroop supplies and equipment by parachute through the opened clearance doors in the aft portion of the body.

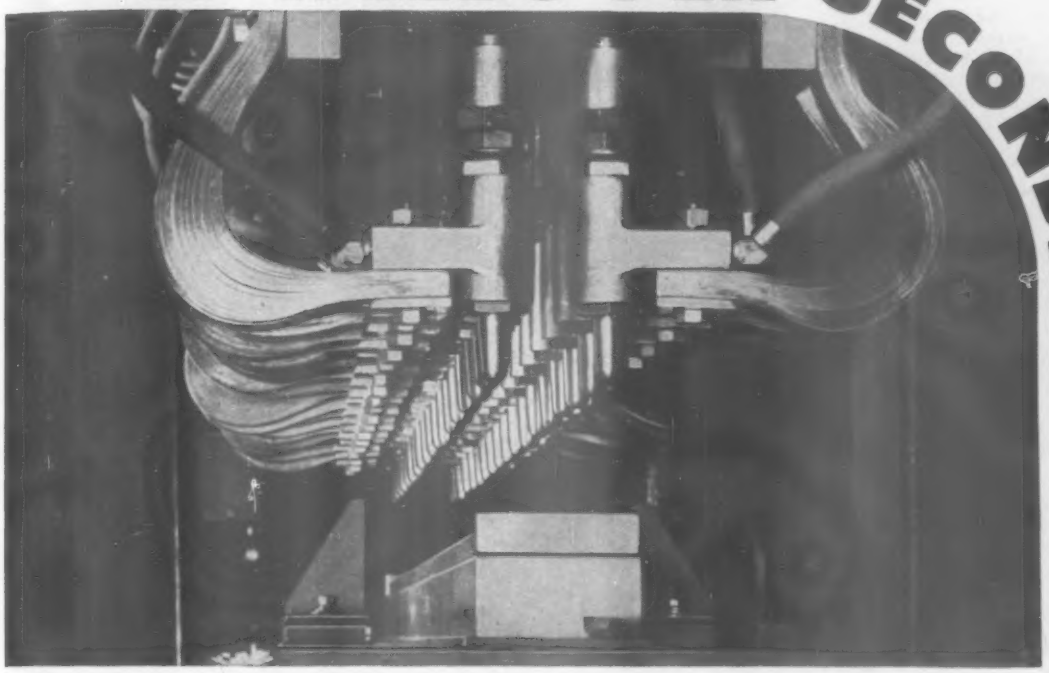
The Conestoga requires a crew of two, a pilot and a co-pilot, whose quarters are in a roomy operating compartment in the nose. Dual controls are installed as well as remote-control radio and facilities for blind landings and take-offs.

The new Budd plane was designed by a staff of engineers directed by Dr. Michael Watter, a veteran airplane designer with a number of famous craft to his credit. It is being built under a Navy Department contract granted in August, 1942.

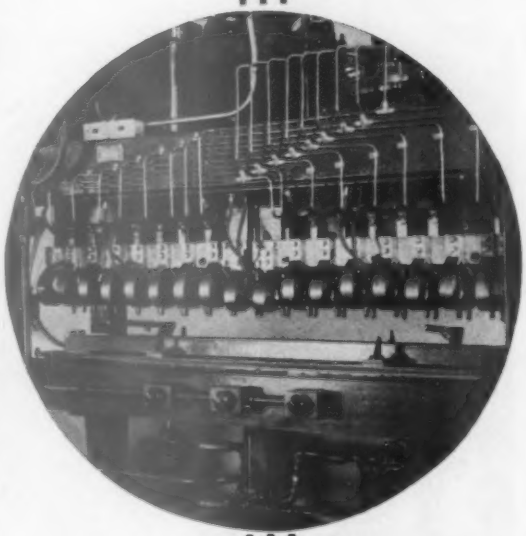
It is interesting to note that the original Conestogas were first made at Conestoga, Pa., which is less than 80 miles from the site of the new airplane plant and flying field where the winged Conestogas are now being assembled.

# 4 WELDS PER SECOND



One reason why spot-welding is making such phenomenal gains as a universal fabrication process is the time and cost-saving speed with which welding operations can be performed. The example here — welding a steel beam assembly five feet long and six inches wide out of a combination of 14 and 20 gage steel—on a Progressive Hydromatic welder is not an exceptional case. Quick acting clamps on the fixture provide locating of the two members of the beam assembly. The center of the table is raised under air pressure from two cylinders below the table against the standard interchangeable PWC hydraulic guns. Once the machine is started by pushing a button, it automatically goes through its complete cycle making 36 welds, 18 to a row, in just a few seconds; the 1/4 inch spots being welded two at a time (in series, electrically). The table is lowered and the completed assembly is removed. Even the amount of heat to different welds is varied automatically to compensate for decrease in welding current due to short-circuiting effect and varying of secondary loop, as more and more welds are completed.



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## The Exchange of Ideas Leads to Progress

### Help Wanted, *please!*

**THIS is the one place where you may "get more than you put in," for all the ideas given here are yours without contributing anything in return. Don't be that kind of fellow, though! If you have a welding idea to pass on, then get the kick of seeing your name in print, help others to win the war and help us to keep this feature alive. Send anything you think suitable to Short Cuts and Kinks, THE WELDING ENGINEER, 506 South Wabash Ave., Chicago 5.—*The Editors.***

## Aluminum Castings Salvaged

A LARGE percentage of the aluminum turret castings that previously had to be rejected because of porosity and hollow spots are now being repaired at The Glenn L. Martin Co., Baltimore, by a process for replacing the porous material with weld metal. The process was evolved by Louis Barrett, tool design process engineer.

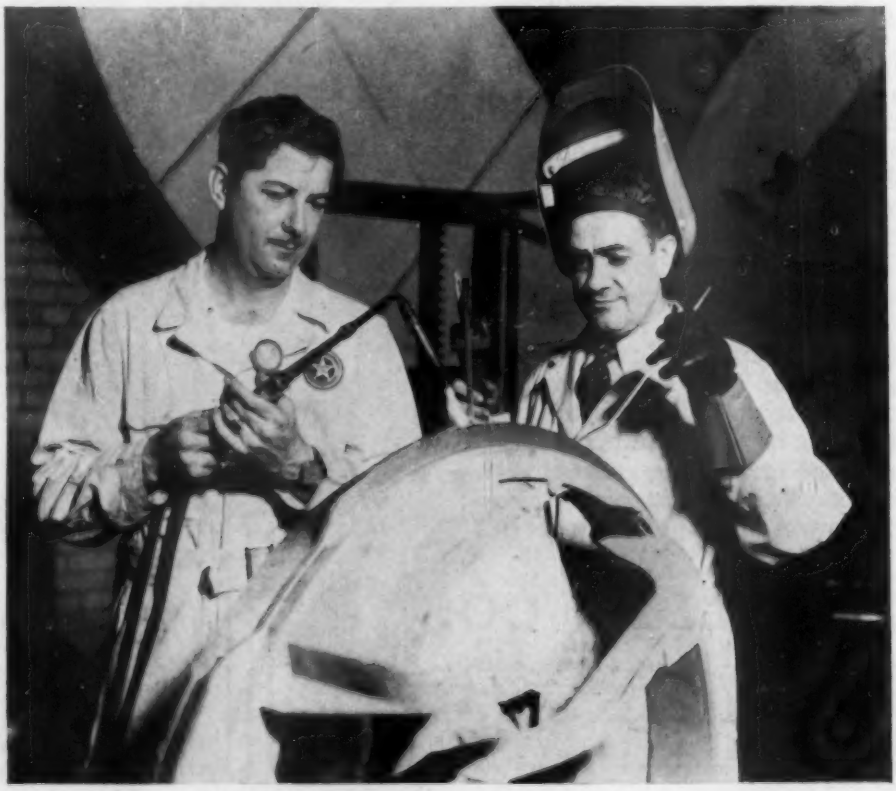
The surface defects in the casting are first removed by grinding out or chipping out the porous material. The casting is then preheated at 200 to 300 F, either in a furnace or by local application of torch heat. Next the cavity is welded or filled with weld metal. This is done with a carbon arc and a coated 5% silicon aluminum electrode used as a filler rod. The welds are cleaned and filed smooth, and the weld area is dipped in a solution that will give it an anodizing (oxide-resisting) coating.

The outstanding features of this welding process are the preheating of the casting and the use of a carbon electrode. The preheating operation simplifies the welding operation and lessens the possibility of cracks by lowering the temperature differential between the point of the weld and the surrounding metal. The carbon electrode when used with a coated filler rod provides a better adhesion between the weld metal and the aluminum casting than would be provided by the same aluminum rod used as a metal electrode.

This new method of repairing defective castings is limited in use to areas of low stresses. Porosity or hollow spots are determined by X-ray examination. After the welded repair, the casting is again X-rayed to insure that a perfect bond between the weld metal and the casting will be provided.

This specialized technique permits the rapid salvaging of castings that are urgently needed on the production line. It is also resulting in the saving of considerable quantities of critical material and many man-hours that went into those castings discovered to be defective by the Martin receiving inspection department.

***The area surrounding the cavity to be welded is preheated at 200 to 300 F with a torch. A second man (in this picture Louis Barrett who devised the process) stands by ready to weld with a carbon electrode and a coated 5% silicon aluminum electrode used as a filler rod.***



## Piercing Machine Speeds Trim

A PNEUMATIC piercing machine designed and built by the American Central Manufacturing Corp., Connersville, Ind., has speeded the accurate trim of stamped collector ring sections prior to welding. As

***With ten tons of pressure behind it, this machine easily pierces through stainless steel sections 0.05 in. thick.***

the picture shows, the piercing machine is applied to the juncture of a port branch and the main ring, where a saw cannot turn. It punches out a perfect radius while maintaining a $\frac{3}{32}$ in. edge flash for welding purposes.

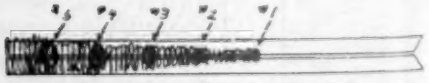
Ten tons of pressure are applied to a standard wave cut punch in order to pierce the 0.05 in. thick stainless steel used for collector rings. The spring stripper which clears the punch also acts as a gauge to insure an even flash edge margin.

» «

## Stagger-Pass Welding

A GENTLEMAN who prefers to remain anonymous contributes this simple rule for stagger-pass or cascade welding. He says:

"When putting in the second pass and all




*Courtesy, Harnischfeger Corp.*

***Diagrammatic representation of stagger-pass welding. The numbers give order of passes.***

successive passes in a heavy weld, we always stop at least an inch behind the place where the preceding pass has been terminated. When that section has been finished, a starting place is left for each bead or pass, and the successive passes will be hot. The weldor will then be in a position to get good fusion in going over the spot where the preceding pass was joined."

# PAGE *Welding* ELECTRODES

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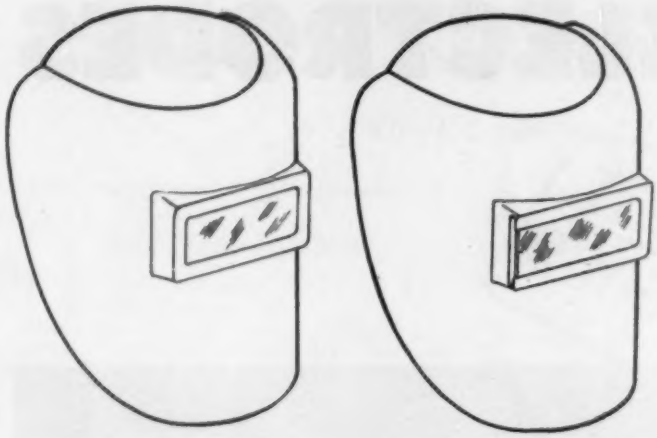


*Old (left) and new methods of holding welding lens and clear glasses. The new holder has an open end to permit rapid insertion of a new cover glass.*

## Simplified Lens Changing

***By Lester M. Bowles***

APPROXIMATELY 4,000 cover glasses have to be replaced daily at the Nine Ways Shipyard of Bethlehem Steel Co., Sparrows Point, Md. The lenses in the welding helmet now in use consist of three glass plates—two of clear and one of dark glass. The latter is sandwiched between the two clear glasses, and all three are held in the lens frame by a retainer spring attached to the helmet.

The outside or cover glass, which is the one closest to the work, quickly becomes pitted by weld spatter and must be replaced frequently—at least three or four times a day in shipyard welding. In order to effect the replacement, it is necessary for the weldor to take off his helmet, take out the retainer spring and then remove all three glasses.

The suggestion I submitted to our local Labor-Management Committee was to have a double lens frame. The inner portion contains a clear and dark glass that are firmly held in place by the same type of retainer spring now used. The outer portion, however, contains the new clear or cover, and this glass is held firmly against the outer frame by a flat steel spring that is attached in the lens frame. One end of the outer portion of the lens frame is left open in order to insert the cover glass (see right sketch above).

With this design, the cover glass can readily be replaced in a few seconds as compared to at least three minutes for the type previously used. The dark glass is not removed or handled at any time, thereby eliminating the possibility of breakage. The cover glass can be safely replaced, even though the weldor may be working on a scaffold, because the replacement can be made with one hand. The old procedure required the weldor to use both hands.

With the old arrangement of glasses, any moisture on the cover glass would flow to the bottom of the frame and finally seep in between the clear and dark glass. This possibility is eliminated by the new design, which provides an air space between the cover and the dark glass. As a final advantage, the life of the retainer spring is greatly lengthened because it does not have to be taken out each time the cover glass is replaced. With the new arrangement, this spring only has to be replaced due to breakage—and this does not happen often.

*Flux-cut depth detector for automatic welder.*

## Automatic Arc Welding

***By Clarence H. Laube***

**Caterpillar Tractor Co.**

ON AUTOMATIC arc welding heads of the type shown in the accompanying picture, it is necessary to cut through the flux in order that the current collector blades can all make contact with the bare welding rod. If this is not done for every blade, the current collector blades which are in contact with uncut flux will be insulated from the rod, and the entire weld current will have to be transmitted by whatever collector blades are in contact. If a large number of collector blades become insulated from the rod, the overload on the blades still in contact will become too great. Overheating and burning of the blades will then occur.

The above situation was apt to arise frequently, due either to cutter motor failure or because of insufficient depth of the cutter. Whenever the collector blades burned off, it was necessary to remove, regrind and reset them. This process required at least an hour and materially shortened the lives of the blades concerned.

To remedy the situation, I made and installed an automatic flux-cut depth detector for automatic welding machines. When this detector is properly connected to the welder control circuit, it will trip out the weld current contactor whenever uncut flux is encountered. Thus burning of the current collector blades is automatically prevented

The detector consists of a spring-loaded insulated blade connected to the welder control circuit. The insulated blade rides in the slit made by the flux cutter. Whenever the blade strikes any uncut flux, its contact with the rod is broken, and the weld current contactor is automatically tripped out. Since this contactor controls the current to the collector blades, the latter receive no current.

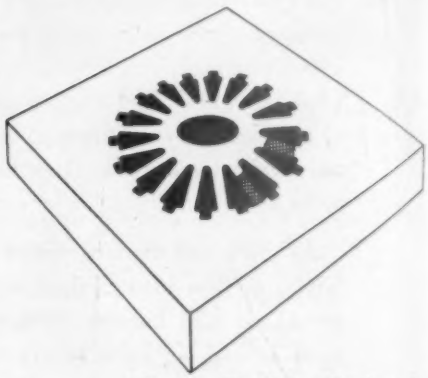
Prior to my suggestion, the collector blades had to be removed, reground and reset approximately three times per week, and a new set had to be installed about every two months. Since the flux-cut depth detector has been installed, collector blade life has increased to six months without any downtime for repair. On two machines, the downtime saved amounts to approximately 312 hours per year and the annual saving in collector blades amounts to about $72.

» «

## Blanking Die Reclaimed

***By Pete Marose***

A BLANKING die in the plant of the New Monarch Machine and Stamping Co., Des Moines, Iowa, broke in the press during a punching operation. Since a new die would have taken three weeks to make at a cost of approximately $200, the foreman of the plant asked about the possibility of repairing the break by arc welding. It was decided to try to make an arc-welded repair of this tool steel die.



*Courtesy, The Hobart Brothers Co.*

***A $10 repair saved the $200 cost of a new blanking die. The shaded areas show where new weld metal was deposited.***

We veed out the breaks and heated the die in an oven at 300 F with a cast iron block. After both had been heated, we took them out and placed the die on the heated block so that it would not cool too rapidly. With the die kept warm in this manner, we proceeded to weld the breaks. Using a ⅛ in. tool steel electrode at 100 amp, we would weld a small bead at a time and peen each weld thoroughly as we went along until the break had been filled. After welding, we placed the die back in the oven and hardened it by using an oil quench.

Including grinding and placing the die back in the press, the entire repair bill came to $10. Our repaired die is still in operation and has turned out over 500,000 steel and 300,000 fibre stampings since we reclaimed it by welding.

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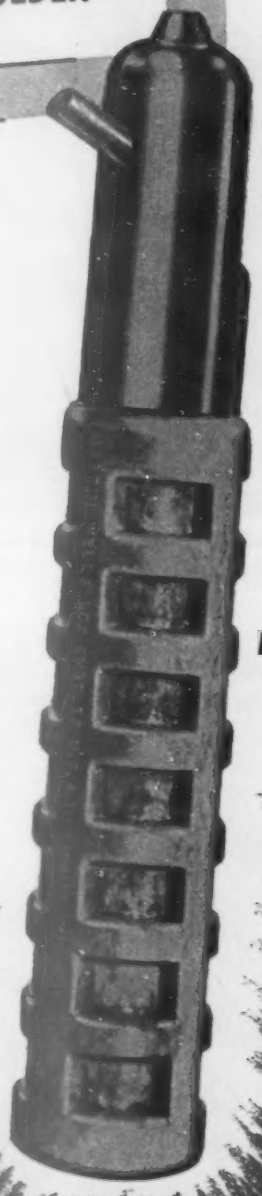

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# On the Job

## Power Trains

TO RESTORE electric service to cities reconquered by United Nations' armies, electrical engineers have put power stations "on the rails." Westinghouse Electric and Mfg. Co. is building nearly a dozen eight-car power trains capable of generating 5,000 kw each. In addition, the company will soon begin the building of over 20 three-car, 1,000 kw trains.

In the larger power trains, turbines, generators, pumps, boilers, pipes, even living quarters for the station operators, have all been skillfully fitted into eight standard-size railroad cars. These include two boiler cars, each designed to produce 40,000 lb of steam an hour (even with the poor coal found in certain parts of Europe), a turbo-generator car and two condenser cars. Electrically driven fans draw hundreds of thousands of cubic feet of air through the condensers every minute to convert the exhaust steam into water that is fed back into the boilers to repeat the cycle.

The tank car, which carries the water for the boilers, is shown in Fig. 1 in process of fabrication. Welding has played a highly important part in the building of this train, as may be seen from the numerous pipes which have to have welded joints.

In Fig. 2, an arc weldor is fastening a jacking support to one of the cars. When the 5,000 kw train is rushed into a city rewon from the grip of the Nazis, jacks will be placed under each car to raise the whole train to the same level so that the pipe lines can be quickly connected from car to car.

*Fig. 1—The letters "PT" mean patrol torpedo boat, but they also mean "power train," referring to eight-car and three-car railroad trains being built to restore electric service to reconquered cities. These workmen are welding pipes on the tank car.*

*Fig. 2—This arc weldor is fastening a jacking support to one of the cars of the eight-car, 5,000 kw capacity power train.*

●

*Below: Arc-welding quartet harmonizes on fast production.*

## Welding Quartet

STRIKING electric arcs instead of high notes, the arc-welding quartet shown in the action picture below is tuned for rapid weld-fabrication of diesel engine starter headers for Uncle Sam's mine sweepers.

This striking photo was taken by 16-year-old Robert Flori, son of the president of the Flori Pipe Co., St. Louis. The Flori Pipe Co. can do almost anything on earth with piping, as will be seen in a feature article to be published in an early issue of THE WELDING ENGINEER.

*Courtesy, The Lincoln Electric Co.*

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## Torch Girls Launch Ship

SHIPS are apparently launched by the glamourous lady chosen to throw the champagne bottle, but it is the spurt of torches underneath the bow that does the actual job. Almost invariably the torch operators are men. At Ingalls yard, however, four attractive young women were recently delegated to cut the retaining plates of an 18,000-ton all-welded ship.

This is the first time that women flame-cutters have performed this operation in the Ingalls yard—probably the first time in the history of ship launchings. After the dog shore test removal of tallow strip covers, the grease irons are taken from their stations and more shores are removed. Wrenches are applied to the collapsible keel blocks, and soon they are out of the way. The sand blocks are then hurried out from underneath the hull, and all is clear as the ship rests within the launching cradles on the heavily greased way. Only the retaining plates are left to hold it from the water.

The signal is given, and the torch girls start their responsible task. The timing of the cutting is short and critical, as are all of the operations preceding it. The four operators must work in close coördination if the ship is to be launched on its split-second schedule.

Slicing the thick steel plates like cheese, the white heat of the flame progresses quickly from hole to hole. As the center of the plate is neared, there is a slight crackle. High above on the launching stand, a bottle is struck against the bow. The plate is now severed and the ship starts down the way, ready to join its sisters on the high seas.

» «

## Fast Bulldozer Repair

*By Chester L. Wright*

THE Caterpillar bulldozer shown in the photo reproduced below broke the link which serves to raise and lower the blade. The white spot just back of the upright member (indicated by arrow) shows where the link was fractured. By cleaning and welding the piece in place, the bulldozer was put back in service in about an hour and a half.

*The arrow points to the broken link (white spot). The repair was made by welding with the piece in place.*

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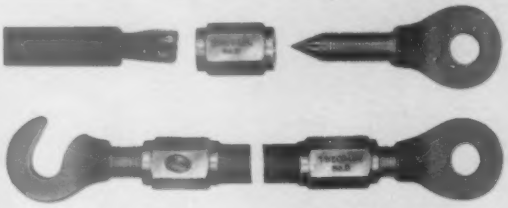
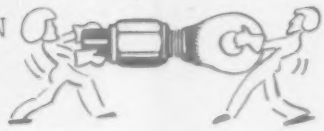


TWECOLUGS are made in three sizes to connect No. 4 through 4/0 Welding Cable.

The TWECOLUG principle is a tapered screw terminal wedging into a hollow seated body giving a POSITIVE CONNECTION  WITHOUT SOLDERING. And in case of cable breakage, field installation is quickly made. Just insert cable strands into hollow seated body and turn screw into nut held stationary. New Beveled side hole in lug nut prevents cable turning or backing out when installing.

TWECOLUGS are made of Special High Copper Alloy. Brass body of lug is hexagon for ease of holding while installing. And TWECOLUGS can take it! They're made heavy enough to stand abuse and will last the life of an ordinary welding machine.

TWECOLUGS are of two types - open type and hole type. Open type TWECOLUGS permit easy installation on machine terminals without completely removing wing nuts. "Connect with TWECO"

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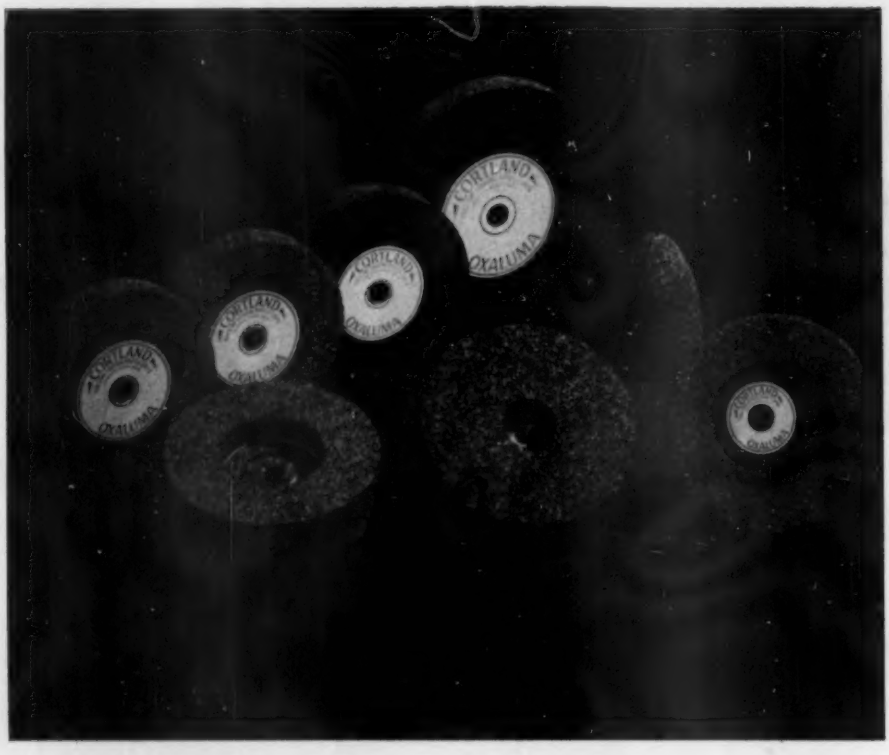


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## Brazing an Ore Roaster

A CAST IRON ore roaster used by a western mining company had developed cracks in its shell on both sides of the supporting ring for one of the steel tires. On removing the insulation, the company

*Courtesy, The Linde Air Products Co.*

**Cracks 50 ft long in the 1⅛ in. thick shell of this cast iron ore roaster were successfully repaired by oxy-acetylene brazing.**

maintenance department found that the cracks were approximately 50 ft long. To replace the big casting would have necessitated a 60 to 90 day shutdown.

The alternative was to effect the repair of the 1⅛ in. thick shell by oxy-acetylene brazing. This process could be used, it was believed, because the repaired area of the roaster would not be subjected to service temperatures above the melting point of bronze (approximately 1,500 F).

The cracks were prepared for welding by veeing them out with air hammers and chisels, an operation that took two men a total of 72 hr. The casting in the vicinity of the cracks was then brought to a preheating temperature of between 300 to 400 F by means of the natural-gas burners that were already installed in its interior. Two small natural-gas burners were used also in order to heat the tire on the outside. During preheating, the casting was revolved so as to obtain an even distribution of heat.

Two weldors went to work, simultaneously welding the cracks on either side of the tire. Some 150 lb of ¼ in. bronze rods were deposited to make the repair, while the oxygen and acetylene consumption amounted to 1,500 cu ft of each.

After welding, the casting was allowed to cool slowly before its insulating covering was replaced. The job was completed in a total welding time of 20 hr, which included the intermittent time-outs necessary to maintain the preheat.

---

**HOW ABOUT sending us some of your own work for "On the Job?" Just a few words and a photograph will do the trick. Payment will be made at our usual rates. Address: Editorial Department, THE WELDING ENGINEER, 506 S. Wabash Ave., Chicago 5.**

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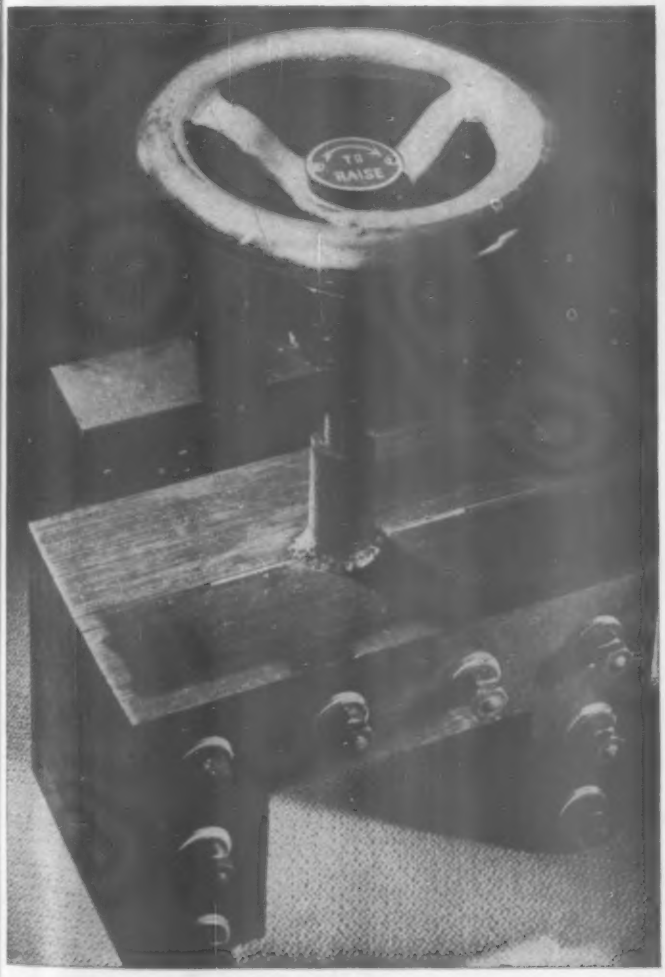
**2** Transformer coil uses *rectangular* copper — glass-insulated — with primary over secondary. Air duct between windings dissipates heat — *prevents* breakdown!

**3** Sturdy lower core is 1-piece, U-shaped . . . of die-punched silicon steel. Insures quiet operation . . . with *no* power-wasting air gaps!




**6** Power regulation is *smooth — quick — simple!* One-inch movement of upper core covers entire welding range — 50 to 500 amps — in *seven turns* of control wheel. Cuts adjustment time to *minimum*. Speeds welding! A 1677

**4** Here's typical Ampac quality — a big, tough, *extra heavy* welding terminal. Note *brazed* connections!

**5** Hardened brass guide is simple, fool-proof! Channel shape provides *extra* strength.

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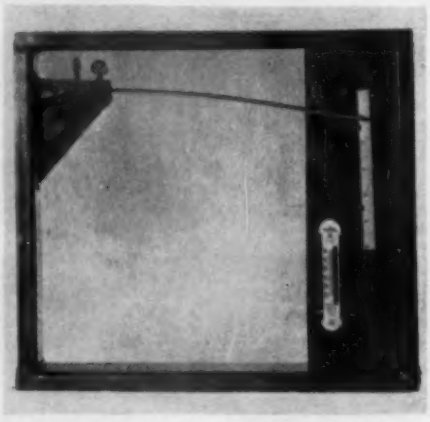
## Rigidity Test Jig

A SIMPLE device for demonstrating the superior rigidity of steel over cast iron is illustrated in the accompanying illustration. This testing unit was devised by C. W. Lytton, Lincoln Electric Co. welding engineer in the Franklin, Pa., territory. It consists of a square-shaped jig made of 2 by ¾ by 5/32 in. channels. The frame is fabricated by welding the channels to form a rectangular structure 15½ by 13½ in.

Two bars ½ in. wide, ⅛ thick and 12 in. long, one of steel and the other of cast iron, are used in demonstrating. In the illustration, the cast iron bar is being tested by inserting one end 1½ in. in a clamping support and applying a load of 2½ lb through the vertical rod attached to the small scale. The other end of this rod is fixed to the cast iron test bar at a point 9¾ in. from the clamping support.

The deflection (shown on the rule at the right of the jig) measures 1 5/32 in. Tested in the same way, under the same load, a steel bar of equal size showed a deflection of 15/32 in. The steel bar is thus 2.44 times as rigid as the cast iron one.



***Jig for making comparative rigidity tests of steel and cast iron bars. The cast iron bar being tested here shows a deflection of 1 5/32 in.***

*Courtesy, The Lincoln Electric Co.*

» «

## Material Elevator

*By Charles C. Lynde*

A SAFE but inexpensive rack for hoisting buckets of material to the top of a high tower was made by an ingenious weldor from a few bits of scrap material. The frame was made by welding together sections of scrap angle iron and adding cross braces to provide additional rigidity and to afford more space for the suspension of hooks for the buckets.

***Welded throughout, this bucket frame is proof against hoisting accidents.***

The bucket hooks are carried through holes flame-cut in the lower surface of the rack. Each hook was made by bending an open loop at one end of a short rod and fitting the other end with a welded head that can be readily turned for quick disengagement of the bucket.

The rack and its buckets are supported by four heavy bars centering in a U-bolt or clevis. The lower ends of the bars were bent 90 deg and inserted through holes in the sides of the frame angles. A nut was then welded on the end of each bar in order to retain it in place. The upper ends of the bars were welded to form eyes that could be threaded on the clevis.

Because of its construction, this rack carries level regardless of whether it is supporting one or the full complement of buckets, and the suspended buckets are automatically fended off from contact with staging on their way up to the unloading point. When the clevis is removed, the four hoisting bars can be folded flat against the angle irons to make a compact unit for shipping.


Knock-Out

A. C. WELDERS

The World Over

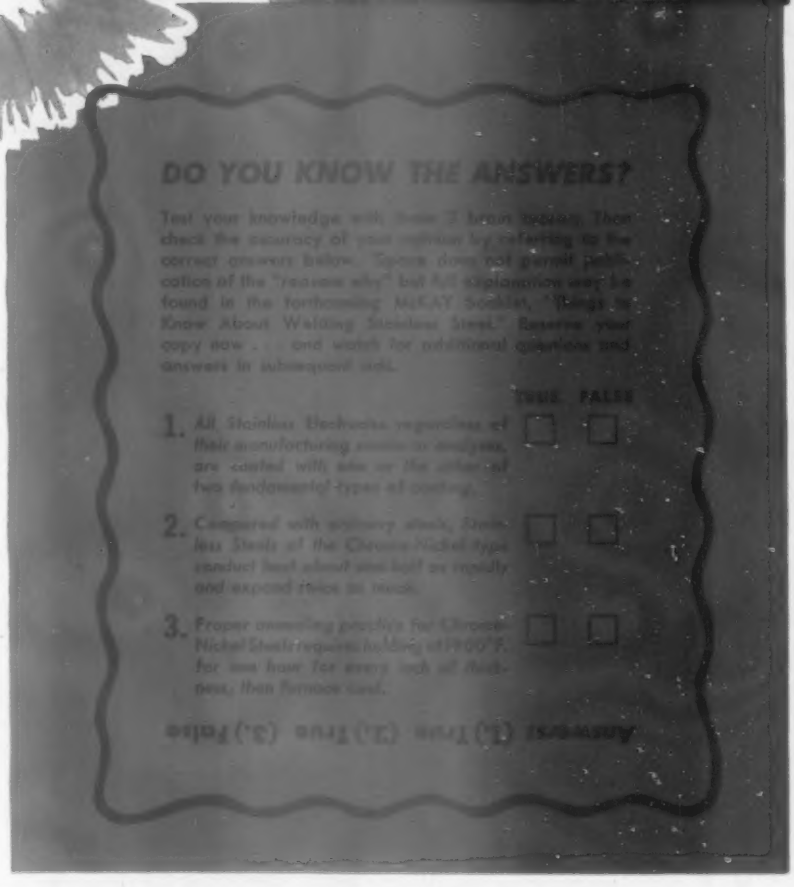
Engineered correctly by men with years of experience. Silent operation, ease in striking arc, wide range of application, low initial cost, economy of operation, negligible upkeep, burn-out proof transformers, all go to distinguish K-O *Welders*. These time-tested units are made to serve their employer well and show him a substantial profit whether on maintenance or production.

20 to 550 amps.

See your nearest K-O jobber or write for bulletin No. 41-74.

K.O. LEE CO.

# *What do you know about* ELDING STAINLESS STEEL?

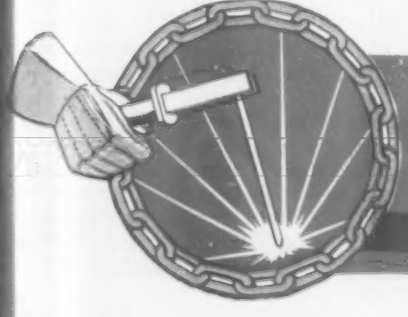



ccessful welding of Stainless Steel depends (1) the type and characteristics of the steel be welded, (2) the suitability of the elec-des used, and (3) *the skill and knowledge the welder.*

The first two factors are constant because production of stainless steel, today, has ched a high state of perfection and . . . *ere is a type of* McKAY STAINLESS STEEL ELDING ELECTRODE, *with exactly cor-t characteristics,* for every stainless weld-need.

The skill and knowledge of the welder, erefore, is of paramount importance! The re technical "know how" you have, the tter.

Can you answer the questions, listed at the ht, correctly . . . and give the reasons for ur answers? These and similar questions discussed in a booklet soon to be released the McKAY COMPANY. It will contain, well, other data useful to every welder. It's e. Reserve your copy today by writing for *Things to Know About Welding Stainless eel."*



*General Sales Office: York, Pa.*

THE McKAY COMPANY
PITTSBURGH, PA.

WELDING ELECTRODES . . . COMMERCIAL CHAINS . . . TIRE CHAINS

# New Products to Use

## Small Electrode Holder

★ "Stubby" is a new light, short, small-diameter electrode holder of 300 amp capacity that has just been announced by **Martin Wells**, 5886 Compton Ave., Los Angeles 1. This holder weighs 14 oz, has

*"Stubby," a new addition to the Martin Wells line of "Suregrip" holders. It has the standard "Rod Saver" design.*

a length of 8¼ in. and a handle of 1¼ in. diameter. Its principal features are adaptability to close-quarter work, high electrical conductivity, 60 deg angle grip on the rod and the fact that it enables the weldor to use electrodes down to the last inch, thus saving up to 14% in electrode costs. Its light, balanced weight and small-diameter handle are expected to make it particularly popular with women weldors.

All metal parts are enclosed by the "streamlined" handle, and there are no screws to work loose and cause arcing. The electrode is gripped—with pressure up to 1,000 psi—without the use of springs.

» «

*CESCO "Cover-Lite," a new development in the lightweight goggle field.*

## Lightweight Goggles

★ A new contender in the lightweight goggle field is an all-plastic safety development of the **Chicago Eye Shield Co.**, 2300 Warren Blvd., Chicago. Though the combined weight of the plastic frame and lenses is only 96/100 oz, the new goggle is said to provide full protection against impact.

The "Cover-Lite" rests lightly on the brow, nose and cheeks without noticeable pressure at any point. It is suited for either men or women workers, is designed to fit varying facial widths and may be worn directly over prescription glasses. An air space eliminates fogging.

## Improved C-Clamp

★ An improved toggle-action C-clamp of 6 in. size with extra-deep 3 in. throat has recently been developed by the **Detroit Stamping Co.**, 372 Midland Ave., Detroit 3. Two adjustable spindles grip the work

*De-Sta-Co Model No. 480. A 6 in. toggle-action C-clamp with a 3 in. throat.*

at any selected point, thus permitting clamping over double angles and other irregular shapes. After the clamping gap has been adjusted to the desired thickness, each spindle is locked into its place and will remain at that setting until manually readjusted.

Quick clamping and release are effected by toggle action. Upon release, the entire upper portion of the clamp swings clear of the work. By changing the location of the retaining bolts, the toggle handle may be adjusted to either horizontal or vertical position when the clamp is locked.

The spindles are copper coated against welding spatter, while the links and handle are plated against corrosion.

» «

## Electrode Holder

Designed for either mechanical or solder cable connections, the new Allison electrode holder is made in two models: a 19 oz. holder to handle heavy work (300 to 500 amp) and a 6¼ oz. holder for lighter jobs (around 200 amp). Both sizes are moulded of heat-resistant plastic to insure full insulation and to eliminate the possibilities of arcing because of slag, moisture or contact with grounded surfaces. There are only three main parts: handle, cable connector and tip. Threading in the tip and handle connection securely grips the electrode. This principle, states manufacturer, permits quick

*Allison electrode holder. For either light work or heavy-duty welding.*

change and allows electrodes to be consumed to within ½ in. of the holder tip. **Allison Tool & Engineering Co.**, 4031 Whittier Blvd., Los Angeles 23.

» «

*Sciaky PMCR O-1. An air-operated rocker-arm spot welder designed with roller bearings at the fulcrum point.*

## Spot Welder

★ A rocker-arm spot welder for production sheet steel work has been announced by **Sciaky Bros.**, 4915 W. 67th St., Chicago 38. Rated 30 kva at 50% duty cycle, this welder will handle two sheets of clean mild steel from 0.016 plus 0.016 thickness up to 0.080 plus 0.080 in. or stainless steel up to a maximum of 0.040 plus 0.040 in. A speed of 180 spots per minute can be attained on two 0.032 in. thicknesses of pickled mild steel. Electrode pressure at 24 in. throat depth is 1,000 lb.

Operation is fully automatic, with controls for welding heat, duration of current, cool period and off period. Current interruption may be either magnetic or by ignitron tubes. Electronic controls and contactor are mounted in a hinged cabinet, with dials and switches convenient to the operator.

# *the new* ACP *electrode*

## . . . FOR SPEED WELDING IN ALL POSITIONS WITH A-C AND D-C REVERSE POLARITY

One of the most important welding developments in the past ten years . . . *it's the new ACP welding rod* . . . engineered and produced to meet the operator's demands of today and postwar for versatile performance and ease of handling. This new Westinghouse electrode simplifies slag removal . . . steps up production and quality welds in all positions.

Flexarc ACP Electrodes form a *light, porous slag* which is easily removed from each pass by light brushing. Delays to allow weld to cool for heavy brushing are eliminated. Operators will immediately sense a drive and penetration equal to, or better than, that obtained with direct current and corresponding all-position, direct-current electrodes.

ACP electrodes are especially suited for shipyard, piping and heavy fabrication work. Complete information, including application data, physical properties, and current ranges, is featured in the new ACP electrode Booklet, B-3353. Learn more about ACP . . . write today for your copy. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

J-21310

### WESTINGHOUSE FLEXARC ELECTRODES AVAILABLE FOR PROMPT DELIVERY

- **ACP—AWS—Class E-6010-11 . . . for high-quality work on mild steels that are not readily positioned. a-c and d-c reverse polarity.**
- **AP . . . Class E-6010 . . . for speed welding in all positions with d-c reverse polarity.**
- **SW . . . Class E-6012-13 . . . for low-current all-position welding on mild steels . . . particularly adapted for welding light gauge steel.**
- **FP . . . Class 6012-13 . . . for high-speed general-purpose welding on low or medium carbon steels.**
- **DH . . . Class E-6020-30 . . . for high-current downhand welding on low and medium carbon steels.**

**Westinghouse**

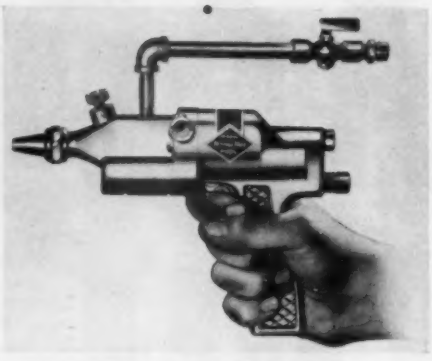
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

# WELDERS AND ELECTRODES

## "Nervous Weld" Equipment

★ The Mogul "Nervous Weld" process is a new development for the reclamation of aluminum, bronze, grey iron, malleable iron and steel castings. Other important uses are the building up of surfaces for press fits, the repair of cracked housings, motor blocks, pump housings, etc. and the preparation of surfaces for metallizing.

The complete installation includes a "Nervous Weld" pistol which requires approximately 60 psi air pressure at 4 to 5 cfm and a welding machine that operates at 110, 220 or 440 volts, 60 or 25 cycle, single phase, a-c. The pistol deposits "atomized" particles of metal which are welded by forging action to the surface undergoing repair. An aluminum, bronze or nickel wire is fed through the pistol by a finger trigger control; it is possible to feed ⅛ to ⅜ in. of wire with one stroke of the trigger. Other operating features include a power chamber and peening motor, an air-cooled nozzle to keep both electrode and work cooled, a needle valve to regulate the air supply and an electrode lug-connector. **Metallizing Co. of America**, 1330 W. Congress St., Chicago 7.



*Mogul "Nervous Weld" pistol. It is used with a special-type welding machine to repair aluminum and other castings.*

» «

*Weltronic Model 120-75 weld timer-contactor package unit for either manually or mechanically operated resistance welders.*

## Weld Timer-Contactor

★ Combination timer-contactor units designed in order to provide simple, low cost electronic control for resistance welders have been announced by **Weltronic Co.**, 19500 West 8 Mile Road, Detroit 19. These "package" combinations may be used either with new machines or to convert manually or cam-timed welders to automatic electronic control.

Any combination of interchangeable NEMA-type timers, together with a choice of ignitron or mechanical-type contactors, may be selected. In addition, synchronous timing and heat control may be added at any time without rewiring or scrapping any element of the basic timer-contactor controls. The selected combination is housed in a cabinet 16½ in. wide by 33 in. high by 10½ in. deep; this cabinet may be either wall or floor mounted. A single power-supply unit will operate all standard control panels from either 115, 230 or 460 volt a-c lines.

» «

## Hydraulic Press

★ The Reimuller "Hy-Speed" hydraulic press is a gap-style hydraulic press designed to handle the hundred-and-one small press operations that occur in the average shop. It is made in two models: 10 and 20 tons with 50% overload capacity. The foot control is operated by two levers: one applying even pressure of any degree as rapidly or as slowly as desired and the other for release. Press is portable, requires no outside air lines and can be quickly shifted about the shop as needed. **Reimuller Brothers Co.**, 9400 Belmont Ave., Franklin Park, Ill.

*(Continued on page 75)*

Ingenious New
Technical Methods
Presented in the hope that they will prove interesting and useful to you.
HAND GROUND
MACHINE GROUND

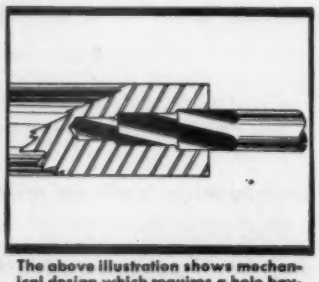
**New Precision Step Drill Grinder Simplifies Production and Maintenance of Step Drills**

**The** quality of a step drill produced by common methods depends almost entirely on the skill and attention of the individual tool maker. However, with the development of the precision step drill grinder, the human element has been entirely eliminated, the characteristics of the step being completely controlled by the grinding machine without adjustments during the course of grinding. This automatic feature insures absolute uniformity, regardless of quantity, and permits large-volume production of step drills.

**The** apparent advantages gained through the use of the step drill grinder are: Permits mass production of drills ground to exact specifications, entirely independent of the human element. Maintenance, too, is no longer an obstacle as step drills produced by this method are quickly sharpened by the same uniform machine-controlled operation. With the step drill grinder step drills can now be made from standard drills. These advantages result in a wider application of step drills which provide a definite saving of machine tools, man-hours and cost; this in turn results in greater production.

**You** know there are plenty of benefits in chewing gum, too. That's why all of the Wrigley's Spearmint we're able to make from our available stocks is going overseas to our fighting men and women. You know what a lift it's been on the job and we wish we could supply everybody, because we have pride, too, in our workmanship and productivity. But there just aren't enough available top quality raw materials right now to do it. When we can produce it in sufficient quantity, it will be back to you with the same fine flavor and chewing satisfaction ...Wrigley's Spearmint has never been changed!

*You can get complete information from Spiral Mfg. Corp., 3022 North Kedzie Avenue, Chicago 25, Ill.*



The above illustration shows mechanical design which requires a hole having diameters diminishing in steps. This is an operation for step drills which has often been neglected due to difficulty in obtaining and maintaining step drills.

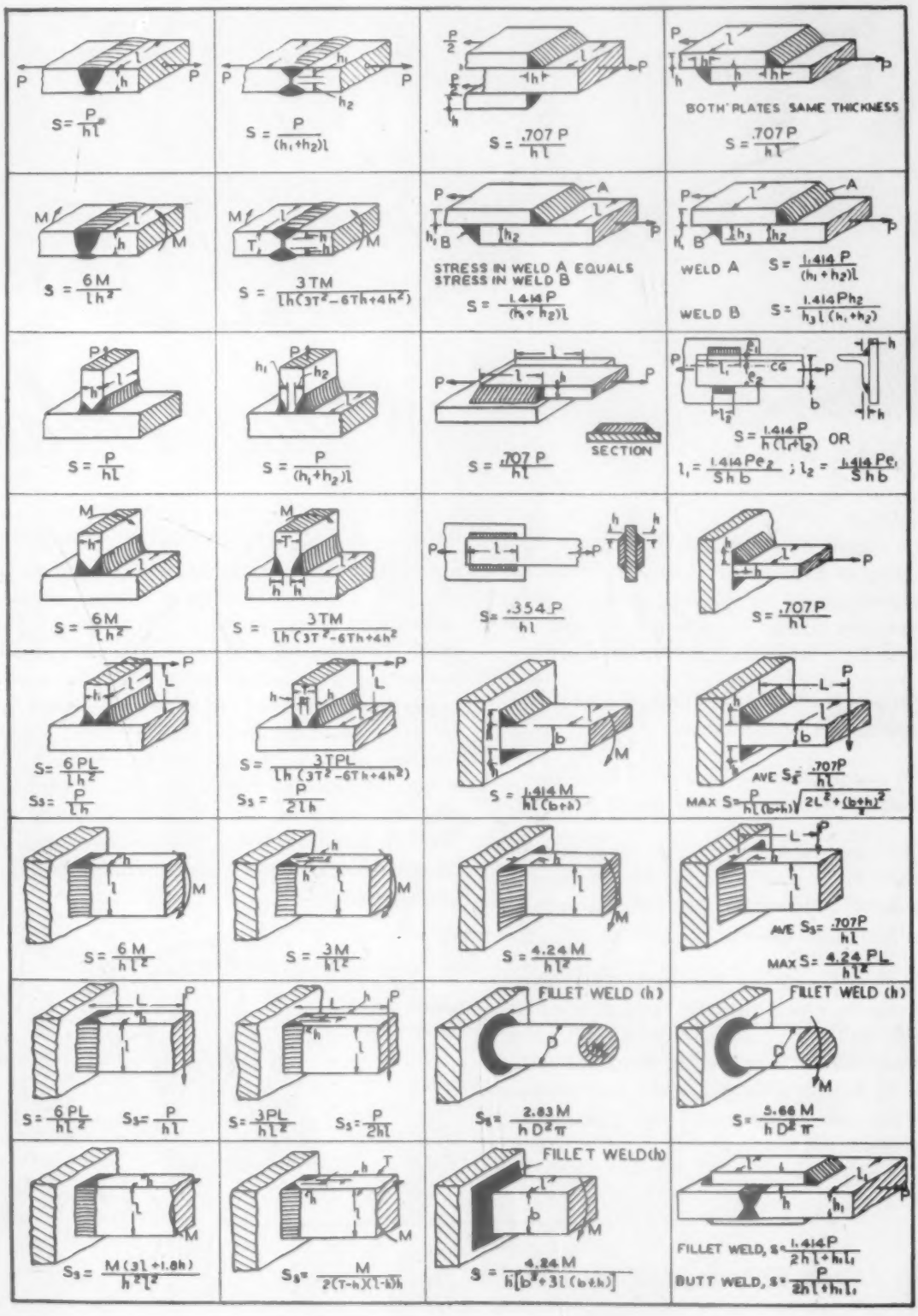
Step drills produced by our method are quickly sharpened by the same uniform, machine-controlled method.

Y-125

# Compute Your Weld Stresses

*By CHARLES H. JENNINGS*

**Westinghouse Electric & Mfg. Co.**




S = Normal stress, psi
Ss = Unit stress, psi
I = Moment of inertia, inch units
M = Bending moment, in lb
D = External load, lb
L = Linear distance
H = Size of weld
l = Length of weld, in.

# INTRODUCING...

## The ALL WEATHER "BUMBLEBEE"

## for outdoor welding

Here's a rugged Wilson AC machine that is ideal for welding in exposed areas and wherever excessive moisture is encountered. Neither snow, sleet, nor rain hinders its reliable, efficient performance. Note these distinctive features:

1. Fully protected against moisture by special moisture-proof insulation.
2. All inside parts are protected by a heavy coating of moisture-proof paint.
3. Enclosed in a sturdy weather proof case, finished in durable, outdoor enamel. Special gaskets and louvers prevent entrance of rain, sleet, snow, etc.
4. Equipped with an automatic low-voltage contactor which instantly reduces open circuit voltage to approximately 40 volts. When the arc is struck, the contactor closes immediately, after which the performance of the transformer equals that of equivalent standard AC welders.

In all other details the All-Weather "Bumblebee" is identical to the standard-type Wilson "Bumblebee" AC machine. It offers the same operating advantages over equivalent DC welders – 15% to 30% more welding per work day, better quality welds, improved power factor, and easy maintenance. It is furnished either as a stationary unit or mounted on a sturdy, stamped-steel, 3-wheel carriage where portability is required.

The All-Weather "Bumblebee" is made in 300 and 500 amp. sizes. Other Wilson AC welders are made in sizes from 100 to 1000 amperes capacity. Mail the coupon for free catalog which gives complete details.

BUY
UNITED STATES
WAR BONDS

MP
Air Reduction Sales Co.
60 E. 42nd St.,
New York 17, N.Y.

Gentlemen:

Please send to me by return mail a copy of the "Bumblebee" AC Machine Catalog (ADW-53).

Name.....

Company.....

Address.....

City..... State.....

AIRCO WILSON

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General Offices: 60 East 42nd Street, New York 17, N. Y.
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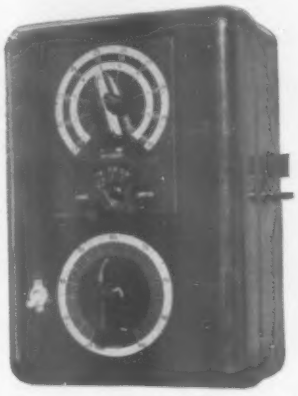
Offices in all Principal Cities

# New Products

*(Continued from page 70)*

## Weld Heat-Treat Control

★ An auxiliary spot-welding control to permit tempering the weld while the work is still in the machine has been announced by the **Industrial Control Div. of the General Electric Co.**, Schenectady, N. Y. It

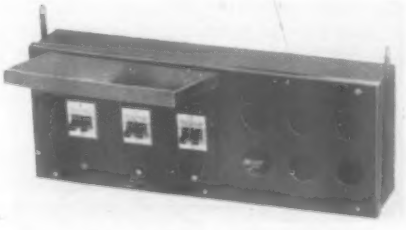


***Auxiliary heat-treating attachment for G-E synchronous spot-welding controls.***

is said to be particularly suitable for the spot welding of air-hardenable steels as its use reduces hardness and increases ductility.

The tempering attachment consists of a heat-control and time-control adjuster with relays which automatically transfer the additional heat-and-time adjustment from the spot-welding control when the attachment is being used. The calibrated adjustment dials are mounted on the hinged door of the enclosing metal case, together with an "on-off" switch for preventing the relays from being energized when ordinary spot or pulsation welding is being done.

» «



***Square D scatter box. An old idea of the theatrical stage is now adapted to the production of ships and aircraft.***

## Circuit Breaker Scatter Box

★ Control of a temporary power and light circuit through a central unit protected by circuit breakers is possible with a newly designed "scatter box" perfected by the **Square D Co.**, 6060 Rivard St., Detroit 11. This unit was designed primarily for shipyards and aircraft plants where a number of temporary circuits must be set up and torn down quickly.

The Square D scatter box is built for from four to eight circuits, with or without neutral. Circuits are protected by 15 amp, 115 volt, single-pole circuit breakers, although 20 or 25 amp breakers can be substituted. The box has a hinged cover which can be padlocked and is provided with a pair of openings for plug receptacles and ears for hanging.

*Fewer rejects, more consistent welds*

WITH **Titan**

**BRONZE WELDING RODS . . .**

When intricate sections of cast iron, malleable iron, wrought iron, galvanized iron, brass and bronze or steel must be quickly and economically welded, you will get best results with Titan Bronze Welding Rods.

Among the factors contributing to Titan's superiority in welding alloys are: use of only the purest of raw materials, scientific joining of these materials, strict laboratory control of mixtures and casting temperatures (known as Double Deoxidation), resulting in greater strength, uniformity and ductility.

Titan Welding Rods are used on repair and production work from coast to coast and have proven their ability to speed up production.

Titan

**METAL MANUFACTURING CO., BELLEFONTE, PA.**

**NEW YORK • CHICAGO • SAN FRANCISCO**

***Quality Alloys By Brass Specialists***

**Brass and Bronze Rod • Forgings • Die Castings • Welding Rods**

# Resisto-Loy

## HARD-SURFACING ALLOY

## *Hard-Faced Plowshares Give 500% Longer Service*

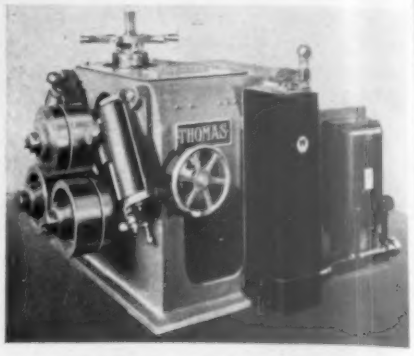
**Tests prove that plowshares hard-faced with either ISOROD or RESISTO-LOY alloys along cutting edge and point stand up under five times as much wear with greater efficiency. These alloys give plowshares an edge and point tough enough to resist the most severe usage—and a hardness that will not chip. They keep the shape and sharpness of the cutting edge. When finally dulled after prolonged use, they can be re-sharpened and hard-faced many times before being replaced.**

**Either ISOROD or RESISTO-LOY are easily applied and are ideal for hard-facing separator cylinder teeth, disc plows and harrows, cultivator points, bean knives, feed mill hammers. They have a wide application on general agricultural equipment. Write for name of nearest distributor.**

Resisto-Loy COMPANY
GRAND RAPIDS 7, MICHIGAN


### Bending Rolls

★ A redesigned line of bending rolls capable of rolling angles, tees, flats, rounds, squares, pipe, beams, channels and special shapes has been announced by **Thomas Machine Manufacturing Co.**, Pittsburgh. Arcs, spirals or circles can also be formed.




***No. 2 size, vertical, in Thomas Machine Mfg. Co.'s new line of bending rolls.***

The new machines are built of welded steel plate and are available in four sizes: for bending angles of 2 by 2 in., 3 by 3 in. and 4 by 4 in. in the vertical-type machines and for bending angles up to 6 by 6 in. in the horizontal type. The vertical-type rolls are on horizontal shafts and bend the material in a vertical plane. The horizontal-type rolls are on vertical shafts and roll the material on a horizontal plane.

» «

### Hard-Facing Jig

★ A jig or stand to be used in the overlaying of hard-facing on internal-combustion engine valves is now available to fleet and truck owners. Its purpose is to hold the valve and turn it slowly by means of foot power as the metal is being flowed on. With this jig, states manufacturer, a valve can be overlaid at a cost of 25c or 30c. **C. A. Kerkling Metals Co.**, 6515 Selma Ave., Hollywood 28.

***"Kor-Valoy" valve machine. This jig permits more economical application of hard-facing to the valves of internal-combustion engines.***

## X-Ray Inspection Unit

★ Norelco "Searchray 150" is a complete self-contained industrial X-ray unit for non-destructive examination of specimens for internal flaws, cracks or foreign matter.

***"Searchray 150." A complete self-contained X-ray inspection unit that provides up to 150 kv potential.***

Even an inexperienced operator can quickly learn how to use this machine, it is stated, since its kilovoltage dial has scales calibrated for various thicknesses of aluminum, steel and brass. Stepless adjustment of potential from 20 to 150 kv is provided. Other features are: an oil-immersed, water-cooled tube; rayproof and shockproof safety features; a storage cabinet for exposed and unexposed negatives; a fluoroscope for visual inspection to supplement the cassette for film exposures; push-button control; an electric timer having a range of from 1 to 20 min with 10 sec intervals and a variable filament control with a range of from 5 to 10 milliamperes. **North American Philips Co., Inc.,** 100 East 42nd St., New York City 17.

» «

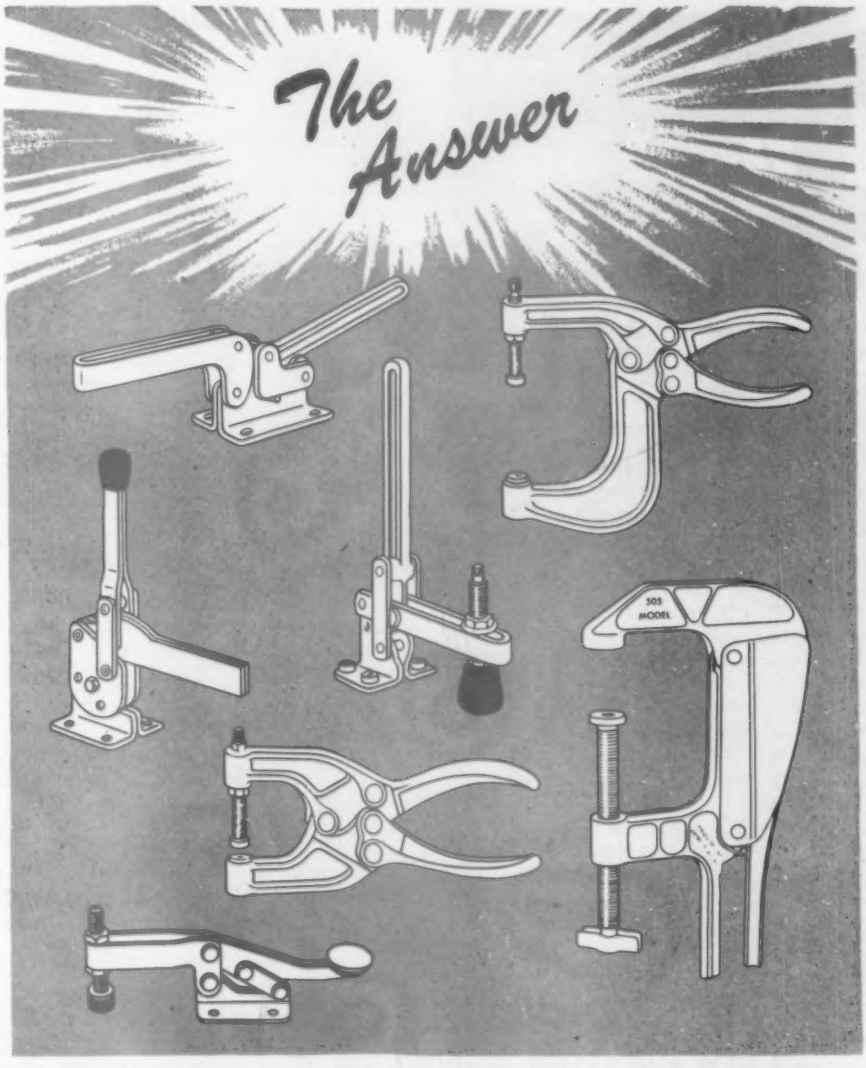
## Hard-Facing Electrodes

★ A line of three hard-facing electrodes distinguished by colored tips is announced by **Rankin Manufacturing Co.,** 1403-05 West Washington Blvd., Los Angeles. All are said to flow with exceptional smoothness, to be easily applied vertically and overhead, to operate equally well on direct or reverse polarity, d-c, or on a-c machines, to bond tenaciously and to permit successive layers to be built up without intermediate slag chipping.

Ranite "A" (blue tip) is highly resistant to shock and has an average hardness of 25-30 Rockwell C. It is recommended for such work as the building up of Caterpillar tractor tracks.

Ranite "B" (yellow tip) is a general purpose hard-facing electrode having a hardness of 44-50 Rockwell C. It is used for crusher rolls and jaws, sand pump housings, gyratory crusher mantles, etc.

Ranite "C" (red tip) has a Rockwell C hardness of 60-62 and is recommended for applications such as bucket teeth, grader blades, etc., where extreme abrasion resistance is required.


**—TO YOUR CLAMPING PROBLEM IS HERE AT**

**KNU-VISE**

—where all our activities are devoted to the engineering and building of clamping devices exclusively.

Building clamps is our only business . . . the job we know how to do, and *do well!* Long experience in solving nearly all types of clamping problems has taught us how to make clamps to meet every conceivable clamping requirement.

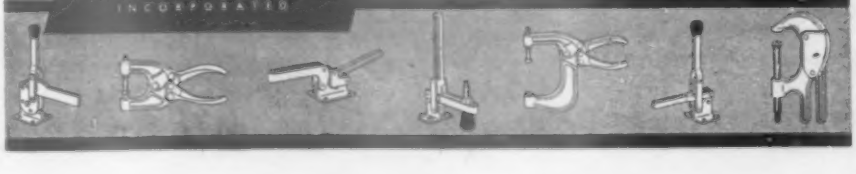
With a KNU-VISE clamp, pressure with unyielding grip can be applied in an instant . . . and work can be released with the same speed. The key to this high efficiency is Toggle Action.

Illustrated are many standard KNU-VISE clamps, but KNU-VISE is equipped to develop also special clamping devices to your unusual needs. Feel free to call upon us for advice on your clamping job.

BUY WAR BONDS

KNU-VISE INCORPORATED

1336 Plum Street, Detroit 16, Michigan
4328 San Fernando Rd., Glendale, Calif.



*If you, as a reader, do not agree with our answers, let us know your thoughts. Your comments and discussions will be published, too.*

### *Weld Cleaning*

*Q*—Are preweld and postweld cleaning operations important in gas welding?—*G. A. Q.*

*A*—Preweld and postweld cleaning are often the most important part of the welding operation. An apparent exception to the general rule may be found in some types of oxy-acetylene welding, but even in this instance the preweld cleaning is automatically accomplished by the preheating action of the torch. Welding and brazing fluxes may also aid in preweld cleaning. Postweld cleaning, however, is rarely required in gas-welding operations unless a corrosive type of flux has been used, as is necessary for the welding of aluminum or magnesium. Obviously, a flux of this type should naturally be removed in order to prevent any likelihood of corrosion of the weld or base metal.

### *Arc Cutting*

*Q*—What type of electrodes are recommended for arc cutting?—*A. C. D.*

*A*—Graphite or hard carbon electrodes are generally recommended for arc cutting because they will retain their points much longer than soft carbon electrodes—a factor quite essential if smooth cuts are required.

Soft carbon electrodes are sometimes used, but they are not generally recommended for arc cutting because of their short service lives. Coated welding electrodes are not recommended because of their cost, but electrodes with either a slagging or a gaseous coating may be used. The slagging type of electrode is usually preferred inasmuch as it can handle higher current densities. Either d-c or a-c may be used when cutting with a coated electrode.

» «

### *Induction Heating*

*Q*—Induction heating is finding important applications in the brazing field. Just how are materials heated by induction?—*M.G.M.*

*A*—Induction heating may be defined as the raising of the temperature of a material by means of the electric generation of heat within that material rather than by any other method such as convection, conduction or radiation. It is a phenomenon caused by an alternating magnetic field; *i.e.*, the area surrounding a conductor carrying alternating current. The reversals of the magnetic field follow the reversals of the current in the conductor. Magnetic material placed within this type of field is heated by both hysteresis and eddy current losses.

» «

### *Skip Cutting*

*Q*—What is meant by skip cutting?—*M.O.N.*

*A*—Skip cutting is a flame-cutting method employed in splitting narrow width materials — flat bar stock, structural I-beams or channels — to prevent warpage. The flame-cut is made in such a manner that a series of uncut sections ½ to 1 in. in length are left along the line of cut. The uncut sections are spaced according to the width of the material and serve to hold the material in line until cool. They are afterwards cut through to separate the parts.

» «

### *Gas Welding Manganese Steel*

*Q*—Can manganese steel be gas welded?—*G.E.N.*

*A*—Manganese steel may be gas welded provided that a large welding tip is used and large puddles of weld metal are maintained at all times. The end of the welding rod should be kept just under the surface of the puddle and should not be placed in the completed weld. The torch flame should be directed in such a manner as to melt the rod in the puddle of the molten metal. The flame used in this welding operation should be adjusted to show a slight excess of acetylene.

**TRI-FLUX**

**A NEW AND BETTER SOLDERING FLUX**

**No. 5 FOR STAINLESS AND MONEL METAL**

**No. 3 TRI-FLUX (Regular) FOR ALL OTHER METALS**

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*Tri-Flux Advantages*

- No need to pre-clean with acid, or oil solvent
- Sticks to wet surfaces. Can be applied without first drying surface
- Can be applied to oily surface without wiping off first
- Sticks to vertical surfaces as well as horizontal. Won't run off
- May be used for hand or torch soldering
- Saves time—one application does three jobs
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- Economically applied—put on with brush—no waste
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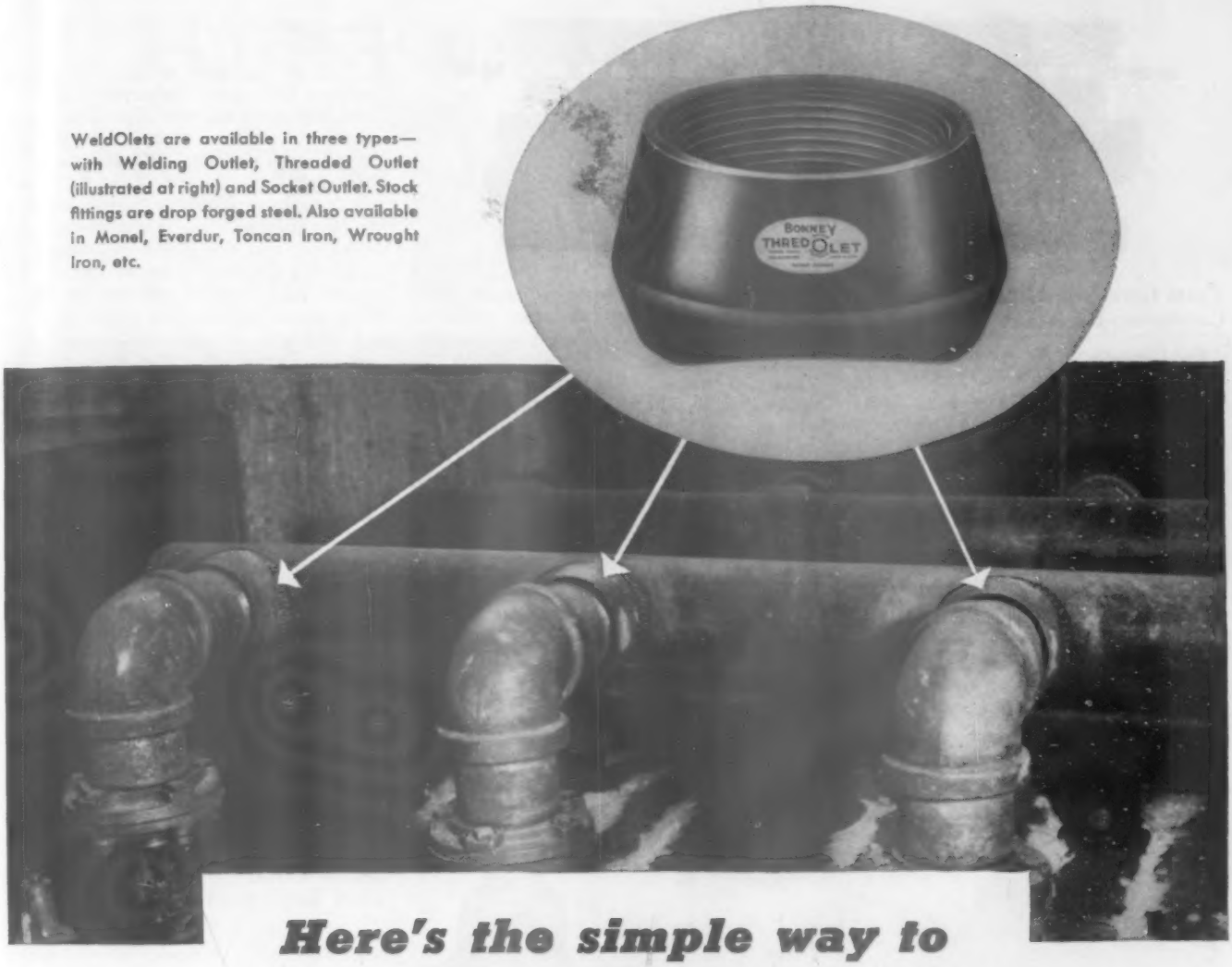
**SHEBOYGAN** • **WISCONSIN**

WeldOlets are available in three types—with Welding Outlet, Threaded Outlet (illustrated at right) and Socket Outlet. Stock fittings are drop forged steel. Also available in Monel, Everdur, Toncan Iron, Wrought Iron, etc.




# Here's the simple way to install branch pipe outlets

● On this piping installation the three branch pipe outlets were installed quickly and easily by the WeldOlet method. The elimination of any templates or the need for any cutting, forming or fitting, speeded and simplified the installation.

These drop forged fittings reinforce the junction so that the original strength of the main pipe is maintained. In addition, the extra large funnel-shaped opening, in the fittings where they join the pipe, cuts pressure loss and reduces turbulence and friction. The WeldOlet method is speedy and low in cost for both size to size or reducing branch pipe outlets. Size to size and reducing sizes are available from ¼" to 12". For complete information write for Branch Pipe Outlet Catalog WT31.

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PAT. IN U. S. & FOREIGN COUNTRIES
WELDING OUTLET - THREADED OUTLET - SOCKET OUTLET
For Welded Branch Pipe Outlets

# News of the Industry

## Tests Give New Data on Corrosion-Resistant Metals

Four groups of 18 selected metal specimens were subjected to combined high temperature and high humidity in order to test the effects of the corrosive atmosphere in an oil refinery on the Gulf Coast. Such an atmosphere attacks metals very actively. The tests covered two groups of metals located indoors and two outdoors and extended over a period of about 18 months.

The metals which will best withstand the combination of high temperatures, high saline humidity and corrosive gases were discussed in an interesting paper presented June 21 before the American Society of Mechanical Engineers, Pittsburgh, by W. L. Maucher and B. W. Jones of the General Electric Co. The tests, said the paper, led to the following conclusions:

1. Of the four electroplated coatings on copper, the tin plating appeared to stand up best. The cadmium was completely gone; the silver showed heavy attack as evidenced by a scaly black deposit which was probably silver sulphide. The lead plating did not look so bad on the surface, but deep pits of the copper base metal were noted on closer inspection.

2. Of the chromium alloys, 18-8 stainless steel and Nichrome V averaged up about the same and rated the best. The 25% chrome steel was somewhat worse, and the 12% chrome steel was decidedly inferior to the three others.

3. Aluminum showed up nearly as well as the 18-8 stainless steel. It was the consensus of opinion that this metal, if anodized and given two or more coats of suitable aluminum paint, would provide one of the most corrosion-resistant coatings.

4. The test on copper and copper alloys showed conclusively that the high-copper metals have a low resistance to corrosion in this kind of atmosphere and should not be used without some protective coating.

5. A comparison of Monel and nickel indicated that nickel was not attacked as much as Monel.

6. The extremely bad corrosion of the unprotected cold-rolled steel indicated the severity of the corrosive atmosphere and emphasized the need for maintenance painting of exposed steel parts.

7. Lead showed up outstandingly well, but because of its low physical properties it did not lend itself to many applications.

8. Silver was heavily attacked, but there was no sign of pitting or noticeable etching. The metal underneath the corrosion film remained very smooth. On large knife switches, the silver surfaces continued to carry their currents satisfactorily.

» «

## Build Tanker Series Named after Important Oil Fields

Keel laying for the first of a series of 24 large tankers to be named for the leading oil-producing areas in California was recently announced by Marinship Corp., Sausalito. Tentative schedules call for the first of these, the *S. S. Kettleman Hills,* to be launched late in August and to be delivered to the U. S. Maritime Commission about the middle of October. Subsequent ships in the series will be built on an increasingly faster schedule. Plans call for the laying of the keel of the second tanker, the *S. S. Elk Hills,* about July 30, and subsequent keel layings, launchings and deliveries will follow at the rate of at least three a month.

Meanwhile, Marinship has been asked to convert six high-speed 10,000 hp tankers, already under construction at the Sausalito shipyard, into Navy oilers. Each of these ships will receive special installations amounting to an 80% increase in the work involved in construction. To fill the order, some 1,500 new skilled shipyard workers are needed.

» «

## All-Welded Marine Diesel Developed for Swedish Ships

A new type of marine diesel of all-welded construction is reported to have been developed in Sweden. A 25% weight saving is claimed to have been effected through the use of welding to replace casting. The new engine is said to develop over 2,750 hp and to be about 25 tons lighter than a corresponding unit made of castings. It will be installed in a 3,300 ton cargo ship being built at Goteborg.


BRONZE WELDING DESERVES AN "E" FOR EXCELLENCE

When breakdowns occur in vital production equipment, bronze welding goes into action to repair the damaged parts and return the equipment to use.

FACTS for WELDERS . . . Here's the most practical, up-to-date data on selecting and using welding rods for best results. Write for your copy.

*For New Work or to make Good-as-New*

BRIDGEPORT

BRONZE WELDING RODS DELIVER STRONGER . . . DENSER . . . TOUGHER WELDS

The reason for the outstanding reliable working qualities of Bridgeport Bronze Welding Rods is the result of continued metallurgical research and development. Noted for their low melting point . . . smooth flow . . . good tinning action and machinability, these high quality welding bronze rods provide stronger, denser, tougher welds for new work or repair of small or large machinery and parts. For Gas or Arc Welding—special alloys for specific applications. Save time, avoid warping.

"EQUAL TO ANY JOB . . . WORTHY OF YOUR SKILL"

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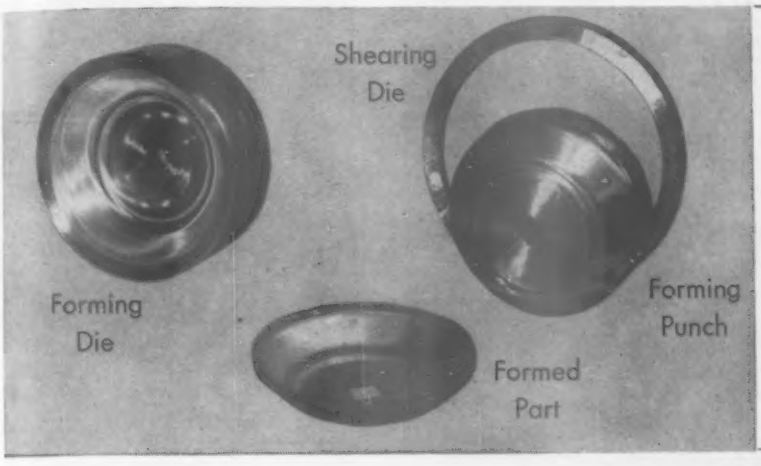
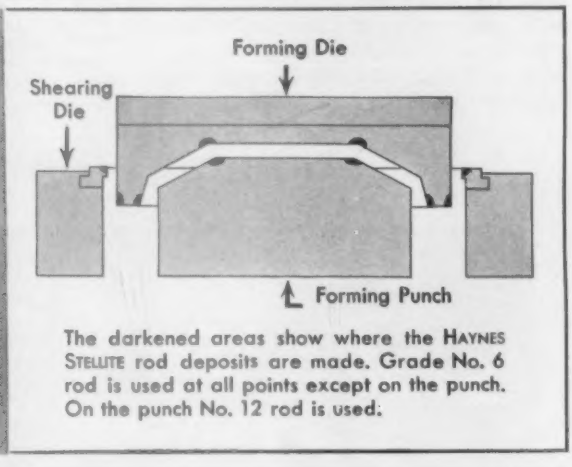
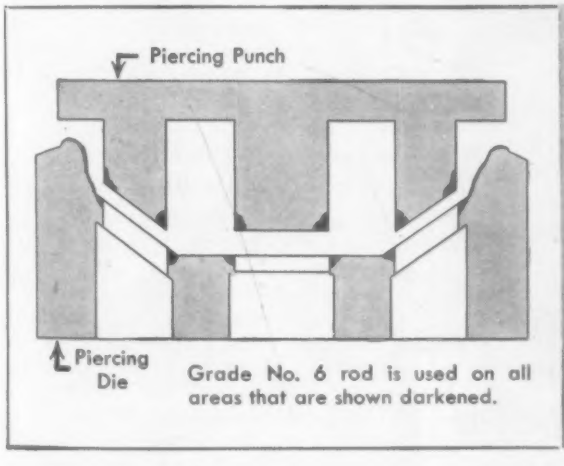
# Hard-Facing saves $2,500 on these Truck Wheel Dies

## *. . . and they last 3 times as long*

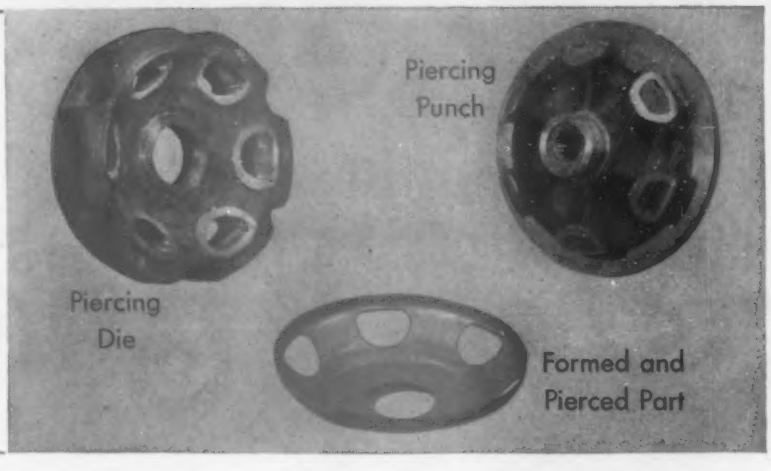



The darkened areas show where the HAYNES STELLITE rod deposits are made. Grade No. 6 rod is used at all points except on the punch. On the punch No. 12 rod is used.




Grade No. 6 rod is used on all areas that are shown darkened.




*The old way cost $4,300.* Formerly these two sets of dies for making truck wheels were fabricated of special steels. They produced only 15,000 blanks.

*The new way costs $1,800.* By making these dies of carbon steels and hard-facing working surfaces with HAYNES STELLITE rods a saving of $2,500 is realized in initial costs. In addition, these hard-faced dies turn out 50,000 pieces.

Hard-facing with HAYNES STELLITE rods is an economical way of increasing life in tools, dies, and many other metal parts subjected to extreme wear and abrasion. You can get more information about hard-facing and how to do it by writing for the booklet "Hard-Facing With HAYNES STELLITE Products."

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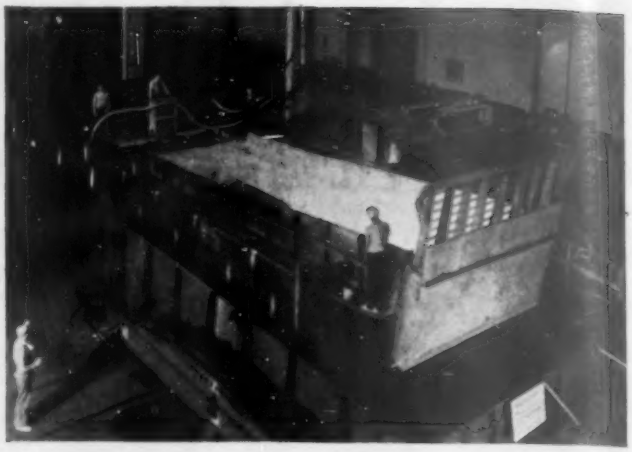
## Navy Barges Launched in 34,000-Gallon Tub

LCM-3 lighters—50 ft barges for landing medium tanks, bulldozers, guns, trucks and personnel—are being built at Warren City Mfg. Co., Warren, O., hundreds of miles from the sea and 50 miles even from Lake Erie. Each LCM-3 is tested by launching it in a huge steel "bathtub" that holds 34,000 gallons and cost $50,000 to construct.

The bathtub test is conducted only a few feet from the end of the barge assembly line. Steel cables are attached to keep the craft from leaping out of the tank. A worker standing at the steering wheel and control panel on the rear pilot deck turns the powerful diesels over slowly, gradually speeding them up until the water in the tank is whipped into white, boiling foam. The barge strains at its cables, riding up and down on its self-created waves.



*LCM-3 barges for landing a medium tank, Navy equipment and personnel are tested at Warren City Mfg. Co. in a 34,000 gallon indoor ocean. The woman worker near the landing ramp in the foreground has started cleaning in preparation for final painting, and a worker may be seen at the control panel on the pilot deck. These diesel-powered landing craft weigh about 25 tons each and can plow through breakers, ground on a beach in landing operations and then pull off under their own power.*

These all-welded craft are constructed upside down in special fabricating jigs on a modern assembly line. The completed hull is then turned over by huge cranes, and deck plates are welded to supporting channels and beams in the well section. After a two hour test in the launching tank, the barges are loaded on their sides on flatcars and hauled to the points of embarkation.

Warren City Mfg. Co., built and equipped by the U. S. Navy at a cost of $9,000,000, has one of the most complete factories in the country for welding, fabricating, machining and assembling heavy types of production.

» «

## Progressive Welder Offers Employee-Ownership Plan

Partial ownership of the Progressive Welder Co., Detroit, has been transferred to its employees as the result of stock purchases by individual workers in both shop and office. In announcing the change in the company ownership, President Fred Johnson said that an employees' profit-sharing plan had been set up a year ago for the benefit of PWC employees. Approval has been requested from Washington on this plan, under which the trustee would also be authorized to make purchases of PWC stock for the benefit of all employees jointly, if the employees so desire.

» «

## Skilsaw, Detroit Stamping Co. Win Army-Navy "E" Awards

Two manufacturers well known to the welding industry were honored by Army-Navy "E" awards last month. Employees of Skilsaw, Inc., Chicago, received for the third time the Army-Navy Production Award for high achievement in the production of war materials. This adds a second white star to the company's "E" flag.

In awarding the Army-Navy "E" to the Detroit Stamping Co., Detroit, special mention was made of the faster production and lower costs attained by redesigning parts of machine design for the stamping process. Also cited was the development of the many types of toggle clamps now widely used for holding parts during production operations including welding.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in your TOOL and DIE costs

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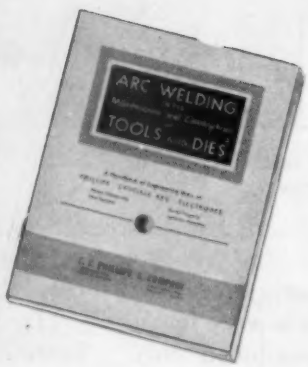
**PHILLIPS "CRUCIBLE ARC"**
*Electrodes for Tool and Die Steels*

FORMING, stamping, forging and blanking dies . . . dies of air-hardening, oil-hardening and water-hardening steels . . . dies that are worn, damaged or defective . . . dies which need the addition of a small amount of metal to accommodate engineering changes . . . dies that have been incorrectly machined . . . dies in all of these categories . . . some of them worth hundreds of dollars, others worth thousands . . . are being reclaimed daily by electric arc welding. Our new manual, illustrated here, explains the theory, outlines procedures and furnishes the engineering data which you need for this work. A copy is yours for the asking.




Get a copy of this new manual and use it as your guide in getting more service out of the dies you have—and in the low cost construction of new dies.

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To more effectively serve the welding industry, Ransome has established a new sales policy of direct distribution by local Welding Equipment Distributors throughout the United States.
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## X-Rays Speed Production at Ford Motor Co. Plants

Of all the war plants throughout the country, Ford is the No. 1 user of X-ray industrial equipment. Radiation at voltages from 5,000 to 1,000,000 is employed to cover the entire range of industrial radiography, from the study of very thin samples by microradiography to the inspection of 8 in. thick steel castings. More than 125 persons are employed in the various Ford X-ray departments. A typical procedure is outlined below:

In the aluminum foundry, two 140,000 volt X-ray units are used to radiograph the repair welds made on cylinder heads for the Pratt & Whitney engine. To speed up the examination of the cast aluminum heads, Ford engineers built lead-lined steel cabinets, 8 ft long and 6 ft high. The exposure is made in these cabinets, behind closed, pneumatically operated doors.

Technicians can make about 700 exposures a day. The cylinder head, which weighs 26 lb, is put on a small platform running on a narrow track through the cabinet. A girl technician places an X-ray film under the welded area and pushes the platform into the cabinet. She then prepares another cylinder head while the exposure on the first is being made. A second operator removes the head and exposed film from the platform, carrying the latter to a film-processing room situated between the two X-ray cabinets.

Ford has two million-volt industrial X-ray units: one in the $27,000,000 aircraft engine building at the River Rouge plant and the other in the new steel foundry. These inspect in 16 minutes the same number of steel parts that formerly required 60 hours with low-powered apparatus.

In order to utilize all of its apparatus to the fullest extent, the company maintains an apprentice training school where a 140,000 volt X-ray unit is used to teach beginners the technique of radiographic inspection.

» «

## Aircraft Steels Can Take Both "Chills and Fever"

While Nazi robot planes are trying vainly to effect a second blitz of Britain, we can pride ourselves upon the fact that we are today making more steel than all the rest of the world put together, including allies, neutrals and enemies. Perhaps a still greater accomplishment, however, is the achievement of U. S. metallurgists in devising alloys to meet special purposes.

A typical case is the development of steels suited to the exacting requirements of aircraft. Each time armadas of U. S. warplanes roar into the air, important tonnages of top-quality steels must undergo the "chills and fever" of combat flying above the clouds.

Aircraft steels are called upon to weather extremes of temperature hitherto unknown to any other mode of transportation. Some idea of what they must stand is given in *Steel Facts*, official publication of the American Iron and Steel Institute:

"Steels in the exhaust systems of big bombers operate at temperatures which rise swiftly from the chill of dawn to the 1,200 F heat which aircraft engines generate as they lift the bomb-laden craft off the ground. When the planes mount to the sub-zero cold of high altitudes, steel valves, collector rings, carburetor intake screens, and other vital parts continue to function smoothly under the swiftly changing temperatures.

"If fire should break out during actual operations, the bomber's crew is protected by a stainless steel fire wall capable of containing the searing high-octane blaze for half an hour.

"Other stainless steels differing only slightly in composition from that used in bomber fire walls retain their toughness even at 300 degrees below zero.

"As the result of years of research into the behavior of steel under heat and cold, steels that meet a wide variety of service conditions have been developed. It has been observed, for example, that steam enters a modern turbine at temperatures hot enough to set a piece of wood afire and comes out too cool for a comfortable bath. Brunt of this sharp change in temperature is borne by the stainless steel turbine blades.

"The tips of those blades sometimes whirl at speeds of over 500 miles an hour."

» «

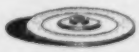
## Distributor Appointed

Welding Equipment & Supply Co., Detroit, has appointed the Welding Engineering Sales Co., 110 East 42nd St., New York City, distributor in the New York area for Eureka tool-steel welding electrodes.


On every finishing job, whether you use this

or this or this

. . . or if you final-finish with

this  or this

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Not only will SKILSAW TOOLS help you turn out more jobs *better and faster,* they'll lower your maintenance costs, because they give trouble-free service longer.

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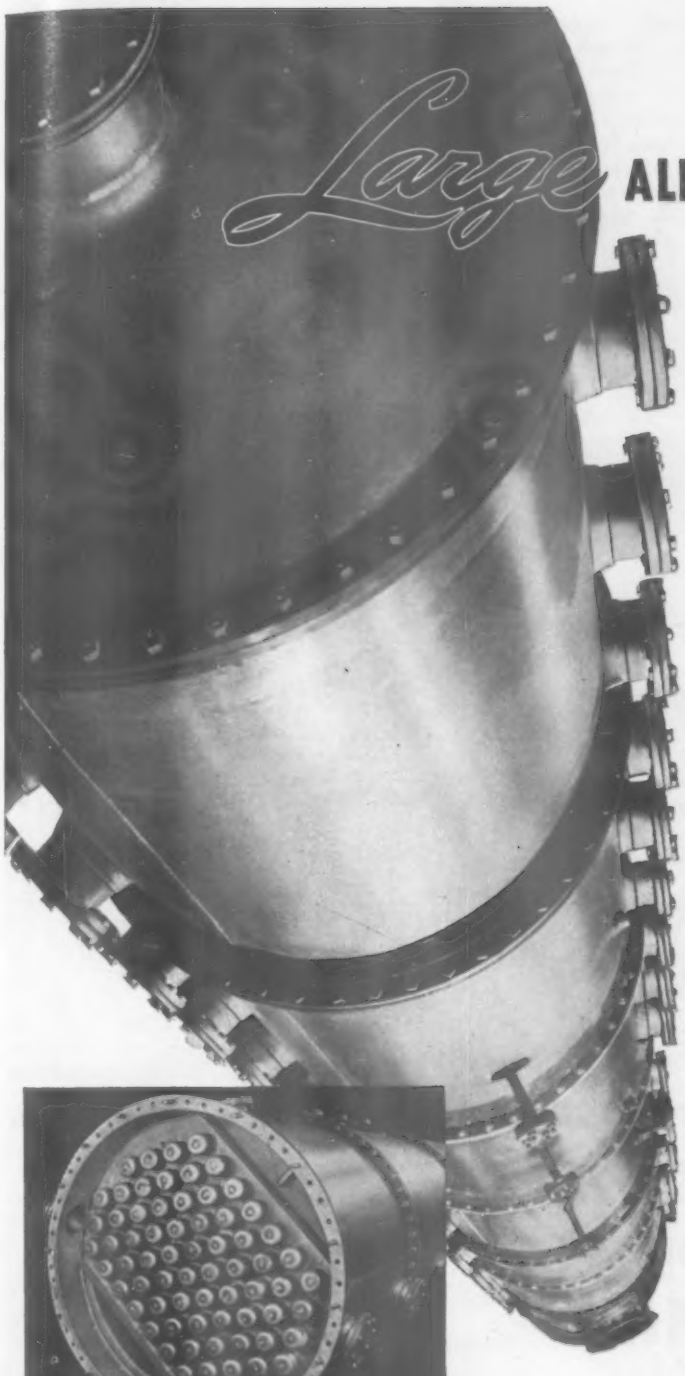
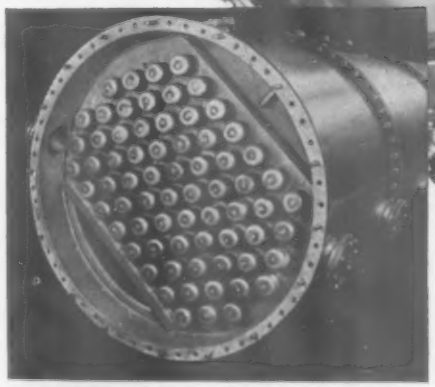
SKILSAW PORTABLE ELECTRIC TOOLS
MAKE AMERICA'S HANDS MORE PRODUCTIVE





**WELDING THE BUBBLE CAPS** to lugs holds the caps down on section of penicillin column, thus eliminating any need for nuts—a novel application of the carbon arc method of welding with promising possibilities.

# Large ALL COPPER CARBON ARC JOB *Welded with* CHASE OLYMPIC BRONZE

Towering over 35 feet (there are seven sections!) this huge "bubbling column" fabricated by Gerstein & Cooper Company is used in the manufacture of penicillin. It is one of the largest all copper jobs ever welded by the carbon arc method of welding.

Progressive welding techniques, employing Chase Olympic Bronze Welding Rods, were used from top to bottom, which includes welding in of outlets, and still angles (used for flanges and stiffening) welded to copper shells.

You may never be confronted with a welding job so unusual. But you may be sure that, whatever the problem, you can count on Chase Welding Rods for quality welds, and on Chase Engineering Service for welding assistance.

CHASE

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*This is the Chase Network—handiest way to buy brass*

## ABOUT PEOPLE

**Stanley B. Kirk** has been elected president of The Linde Air Products Co., The Prest-O-Lite Co., Inc., Dominion Oxygen Co., Ltd., and Prest-O-Lite Co. of Canada, Ltd. He entered the employ of Union Carbide Sales Co. in 1915 and has since that time been responsible for sales and sales management in the gas group of subsidiaries of Union Carbide and Carbon Corp.

**Francis P. Gormely** has been elected president of Haynes Stellite Co., Electro Metallurgical Co., Electro Metallurgical Co. of Canada, Ltd., Michigan Northern Co. and Union Carbide Co. of Canada, Ltd. He joined Union Carbide Co. in 1909 at Sault Ste. Marie, Mich., as an electrician and has served continuously in various production and executive capacities since that time.

» «

**Dr. Joseph G. Davidson** has been elected president of Carbide and Carbon Chemicals Corp. and Carbide and Carbon Chemicals, Ltd. He participated in the early work in synthetic organic chemistry which led to the foundation of Carbide and Carbon Chemicals Corp. and has served in this company in technical and executive capacities since its formation.

» «

**Arthur V. Wilker** has been elected president of National Carbon Co., Inc., and Canadian National Carbon Co., Ltd. He became associated with National Carbon Co. in 1910 and has been responsible for production and important research work in the manufacture and use of carbon and graphite products.

» «

**Clinton E. Swift** has joined Eutectic Welding Alloys Co. as assistant manager of the engineering and research department. He was formerly manager of the welding division of Ampco Metal, Inc., and prior to that was a welding engineer for the C. F. Braun Co. of California. He has also been on the engineering staffs of American Brass Co. and Westinghouse Electric and Mfg. Co.

» «

**Thomas J. Skailes,** a well known marine diver who specializes in underwater welding and cutting, has become a partner in the firm of Geo. Isenberg & Son & Skailes, general contractors, Baraboo, Wisc. Mr. Skailes, a retired Army captain of World War II, has done considerable work in the field of underwater welding and cutting and is well known for his diving during the building of Fort Peck dam and other construction and salvaging operations throughout the United States.

» «

**Henry D. Engelsman** has been appointed sales manager and technical service supervisor of The Metallizing Co. of America. He was formerly a sales and service engineer for The DeVilbiss Co.

» «

**G. L. Revell** has been appointed district manager of the Portland, Ore., office of The Lincoln Electric Co. He is transferring from California, where he has been a welding engineer in the Los Angeles and San Francisco offices, and succeeds **E. H. Weil,** who is now a lieutenant in the Navy.

» «

**J. W. Donnelly,** recently associated with Industrial Supply Co. of Salt Lake City, is now with the Portland, Ore., office of The Lincoln Electric Co. He had worked for a number of years as a trouble shooter and welding engineer at the Lincoln factory.

» «

**George H. Rose** has been appointed assistant to vice-president of the American Steel & Wire Co., Cleveland. **Eugene J. Reardon,** formerly assistant chief engineer, has been named chief engineer of this company in order to succeed Mr. Rose.

» «

**William Blackie** and **William J. McBrian,** comptroller and treasurer respectively, have been made vice-presidents of the Caterpillar Tractor Co.

IT'S *Quicker* TO USE A

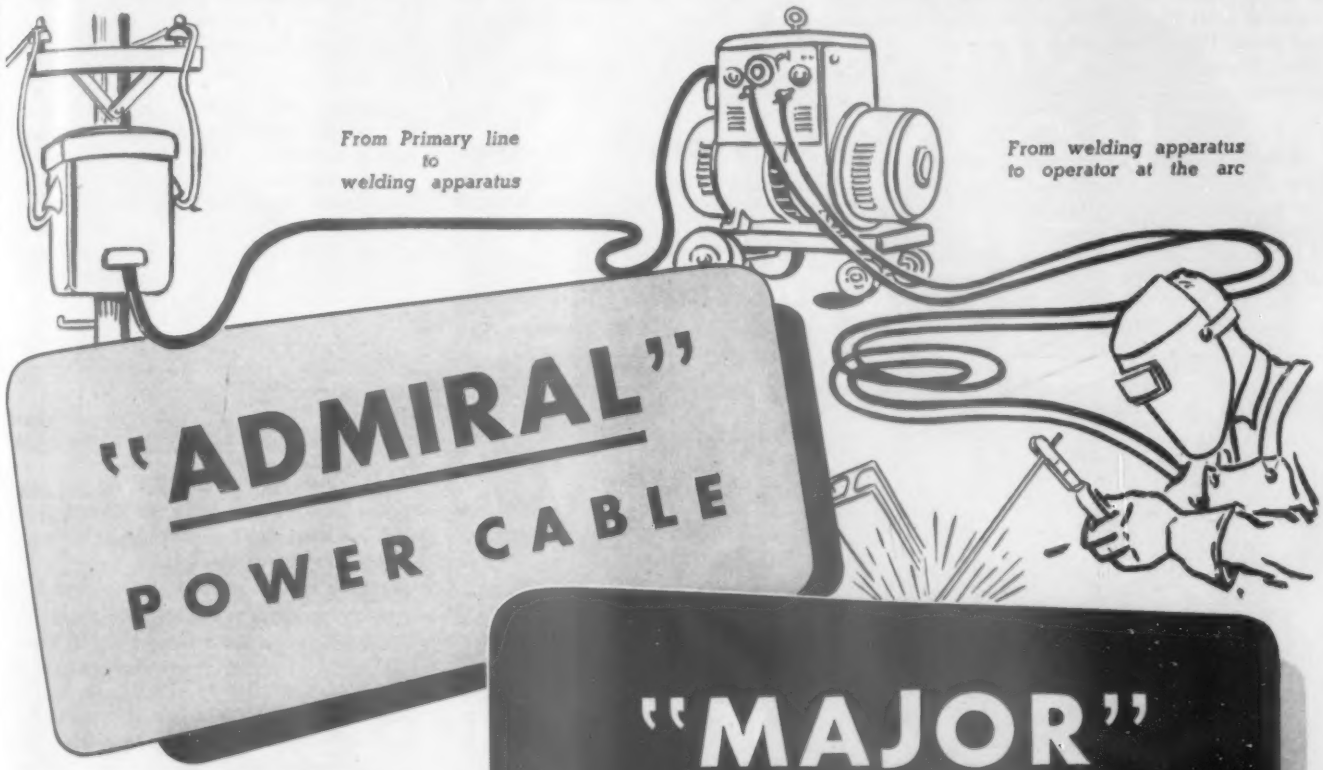
CMD *Triple-Duty* CHIPPING HAMMER

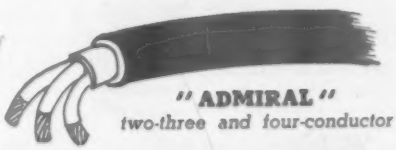
**Triple Duty TYPE CB**
3 tools in one. Brush replaceable when worn. Well balanced. Weight 1 lb.

With the Type CB combination drift and chisel hammer, a welder can greatly speed up his output. For he can spend more time welding and less time removing slag—less time laying down tools and picking them up. Without even setting aside the electrode, he can start immediately to chip away the slag. The handy replaceable brush on the handle of this hammer is instantly available when he needs it. For details and prices on this and other popular CMD welders' Chipping Hammers, ask your jobber for latest circular or write direct.

CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY
1928 WEST 46th ST., DEPT. W., CHICAGO 9, ILLINOIS

# DESIGNED TO TRANSMIT POWER!


From Primary line to welding apparatus
From welding apparatus to operator at the arc
"ADMIRAL" POWER CABLE
"MAJOR" WELDING CABLE



"ADMIRAL" two-three and four-conductor

"MAJOR" single conductor

## SPECIFICATIONS

### "ADMIRAL"

A flexible type primary power cable, WPB approved rubber covered, two, three or four-conductor construction; used with A.C. transformer type or electric motor driven D.C. generator type welders.

| Size No. | Amps. |
|---|---|
| 18 | 3 |
| 16 | 6 |
| 14 | 15 |
| 12 | 20 |
| 10 | 25 |
| 8 | 35 |
| 6 | 50 |

### "MAJOR"

A super-flexible, extruded type, rubber covered welding cable-conductor composed of many fine copper wires properly stranded for transmission of special electrical energy supplied by welding apparatus to the arc.

| Size No. | Amps. |
|---|---|
| 6 | 75 |
| 4 | 125 |
| 3 | 150 |
| 2 | 200 |
| 1 | 250 |
| 1/0 | 300 |
| 2/0 | 375 |
| 3/0 | 450 |
| 4/0 | 550 |

*Write, Wire or Phone*

**WELDING ENGINEERING COMPANY**
MILWAUKEE, WISCONSIN
*MANUFACTURERS — DISTRIBUTORS*
OFFICES AND AGENTS ALL OVER THE UNITED STATES

**Robert H. Ramage** has been appointed advertising manager of the headquarters division of the American Brake Shoe Co. in New York City. He has been associated with Brake Shoe since 1936 and has since 1939 been editor of the *Brake Shoe News*, a monthly paper for employees.

» «

**Robert L. Coe**, vice-president of Chase Brass & Copper Co., Inc., Waterbury, Conn., was re-elected president of the Copper and Brass Research Association at its recent 24th annual meeting. Other officers elected were: vice-presidents: Wylie Brown, president of Phelps Dodge Copper Products Corp; William M. Goss, vice-president of Scovill Mfg. Co.; Curtis L. Smith, treasurer of the National Copper & Smelting Co.; Herman W. Steinkraus, president of the Bridgeport Brass Co.; treasurer: C. Donald Dallas, president of Revere Copper and Brass, Inc.; manager: T. E. Veltfort; secretary: B. B. Caddle.

» «

**John M. McKibbin**, formerly manager of the application data and training department of the Westinghouse Electric and Mfg. Co., has been appointed assistant to vice-president.

» «

**Thomas H. Speller** has acquired the assets of the General Engineering Co., 785 Hertel Ave., Buffalo 7, and will carry on the business under the same name. The partnership heretofore conducted under the name of General Engineering Co. has been dissolved by the retirement of Wilbur Johndrew.

» «

**Edward W. Jackson**, formerly assistant to the president, has been advanced to the post of general parts manager of the Caterpillar Tractor Co. This appointment fills a vacancy created several months ago when **L. G. Morgan** resigned to move to California and become head of parts department activities on the Pacific Coast.

» «

**Professor Hugh E. Keeler**, Mechanical Engineering Department of the University of Michigan, has been appointed a member of the American Standards Association's Committee on Code for Pressure Piping. The work of this committee covers the design, manufacture, test installation and operation of pressure piping systems.

» «

**M. D. Bensley** has been appointed general manager of the three plants of H. K. Porter Co., Inc., of Pittsburgh (not to be confused with the H. K. Porter Co. of Everett, Mass.). The plants, which recently became Porter subsidiaries, are Mt. Vernon Car Mfg. Co., Wheel Foundry Div. of Mt. Vernon Car and J. P. Devine Mfg. Co. Mr. Bensley was for the past 15 years with the Shenango Penn Mold Co., Pittsburgh.

» «

**W. J. Mohr** has joined the export division of American Brake Shoe Co. as a foreign representative in Central America. He was formerly with Lincoln Electric Co. and Armco International Co., acting as overseas sales manager of the latter organization for five years. For the past 18 months he has been in charge of a quinine mission to Peru.

» «

**Robert H. Haley** has been appointed general traffic manager of American Steel & Wire Co., Cleveland. He has for the past six years been New England district traffic manager of U. S. Steel Corp. subsidiaries.

» «

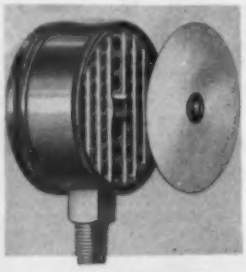
**E. H. Broden**, former manager of operations of the Pittsburgh district of the American Steel & Wire Co., relinquished his post on June 1 after almost half a century of service with this company.

## Died . . .

**Clarence C. Horner**, credit manager of the Emerson Electric Co., St. Louis, died on May 25.

» «

**Ira D. LeFevre**, comptroller of the General Electric Co., died June 4 at the Clifton Springs Sanitarium where he had been a patient for 2½ months. He was in his 61st year.



**EXCLUSIVE SAFETY FEATURE**

*Extra protection for operator and plant equipment is provided by this grid-retainer plate in Moto Meter Pressure Gauges.*

**PRESSURE GAUGES** FOR OXY-ACETYLENE APPARATUS

Like magic, the bright flame of the oxy-acetylene torch speeds to accomplishment the tasks of construction, conversion, reconditioning, repair. Serving to maintain oxy-acetylene processes at peak efficiency are Moto Meter Pressure Gauges. Ever-present aids to the operator, they help to insure correct pressures for each job and to conserve vitally needed gases for essential operations.

**THE ELECTRIC AUTO-LITE COMPANY**
INSTRUMENT & GAUGE DIVISION
CHRYSLER BUILDING, NEW YORK 17, N. Y.
FACTORY LA CROSSE, WISCONSIN

Type **BX** (Patented)

# Use this JACKSON EYESHIELD on gas welding and cutting jobs

- buy it at a new low price

**NOW $3.75**

**Comfortable to wear, it provides adequate protection, ample ventilation. Opaque side protectors. Multiple adjustment. Federal Specification Lens held securely in place in durable retainer. Manufacture in larger volume has resulted in 16⅔% price reduction. Contact your dealer or write us for folder.**

## JACKSON PRODUCTS

3265 Wight Street
Detroit 7, Michigan

In Canada: C. H. Henze Co., Windsor; Hollup Corporation, Limited, Toronto; Leavitt Safety Appliances Co., Toronto; Paragon Supplies, Limited, Vancouver; Flecks Bros. Limited, Vancouver.

# Save Time While Reloading!

*How* TO SPEED UP WELDING OPERATIONS!

## Use This Dual Automatic Welding Fixture!

Automatic Welding-head Positioner — adaptable to your own holding fixture.

**THIS Acme dual fixture arrangement permits practically constant use of an automatic welding head, because one of the fixtures can be reloaded while the other is engaged in the welding operation.**

**The holding machine can be set to revolve at any angle from vertical to horizontal. (Illustration shows a wheel being welded at 45° angle.) Positioner arm swings from one fixture to the other, locking in proper position. Speed of rotating the work is adjustable, as desired.**

**WRITE**
for information relating to your particular welding fixture problem

## ACME Manufacturing Co.

1642 HOWARD ST. • DETROIT, MICH.

# Helpful Literature Just Published

*The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.*

## Flame-Cutting Guide

A useful pocket-size slide-type guide to machine flame-cutting. It may be set to desired steel thickness in a range of from ¼ to 12 in. and will give such data as torch tip number, oxygen and acetylene pressures, oxygen and acetylene consumption, average cutting speed (inches per minute), approximate width of kerf and the numbers of cleaning drills for cutting and preheat orifices. The information is confined to Airco styles "45" and "124" machine-cutting tips, but all sizes of these two tips from 0 to 10 are included. **Air Reduction Sales Co.**, 60 East 42nd St., New York City 17.

» «

## Welding Safety Standards

Early in June, 1943, the American Welding Society, the International Acetylene Association, the National Electrical Manufacturers Association and the Division of Labor Standards of the U. S. Department of Labor requested the American Standards Association to initiate the development of an American War Standard for safety in electric and gas welding and cutting operations. This project was duly initiated by ASA under its War Standards procedure, and a committee chairmanned by John E. Long, Delaware and Hudson Railroad Corp., was appointed to develop this much needed welding and cutting safety standard.

As a result of the committee's labors, there has just been published the new American War Standard Z49.1-1944, "Safety in Electric and Gas Welding and Cutting Operations." This 32-page, letterhead-size booklet is intended as a guide for the protection of workers from injury and illness and for the protection of property from fire or other damage. It covers gas-welding and gas-cutting equipment, arc-welding and arc-cutting equipment, resistance welding equipment, fire prevention and protection of personnel, ventilation and health protection. Every phase of safety applicable to all ordinary welding, cutting, brazing, lead-burning and flame-treating operations is covered but not the special hazards inherent in the operation of industries such as explosives manufacture, etc.

The standard is priced at 40¢ per single copy, lower prices for quantities. Address: **American Standards Association**, 29 West 39th St., New York City 18.

» «

## Welding Fittings Chart

A handy pocket-size dimensional data chart gives complete quick-layout information on every Tube-Turn welding fitting and flange. Printed in two colors, the 9 by 24 in. chart can either be spread out on a desk or folded (like a railroad timetable) into a 9 by 4 in. folder. Tube **Turns, Inc.**, Louisville, Ky.

» «

## Positioner Bulletin

Complete specifications of the recently announced P&H model WP-2 welding positioner are given in a six-page, two-color letterhead size bulletin, No. P2-1. Address: **Welder Division, Harnischfeger Corp.**, Milwaukee 14.

MAINE to CALIFORNIA
MARQUETTE
Welding experts
WILL SHOW
TO YOU HOW!
● GET MORE OUT OF YOUR PRODUCTION LINE
● CUT COST AND TIME OF METAL FABRICATION
● IMPROVE PRODUCT QUALITY
● MAKE FAST REPAIRS OF VITAL EQUIPMENT Without hard-to-get replacement parts.
● SAVE CRITICAL WAR MATERIALS
There is a member of Marquette's country-wide staff of welding experts near you. He has the "know-how" and with it he will bring you the latest, up-to-the-minute developments and applications of welding for faster and cheaper metal fabrication or repair.
You assume no obligation in having a demonstration . . . in your own plant, on your own work . . . of how, with a Marquette, you can really capitalize on the amazing money and time-saving possibilities of this modern equipment.
LOW INITIAL COST — NEGLIGIBLE UPKEEP
LOW COST OPERATION — FAST, FLAWLESS WELDS
10 Models, 125 to 400 Amp. Completely Equipped
Send for free 24 page, illustrated booklet
MARQUETTE MFG. CO., INC.
Minneapolis 14, Minn.
MARQUETTE
REGISTERED U.S. PAT. OFFICE
a.c. arc welders

# C-F POSITIONERS

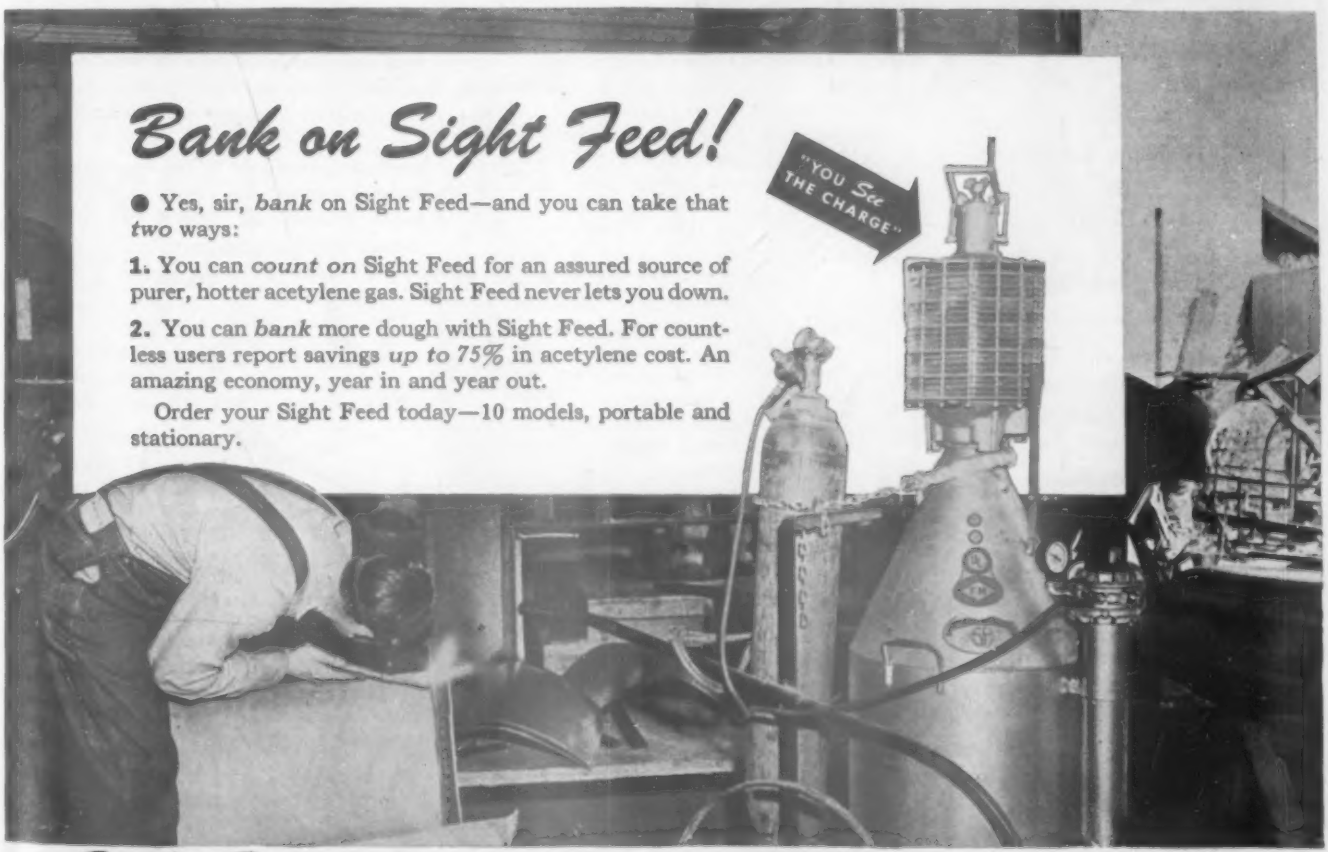
## LESS HANDLING–MORE WELDING

C-F Positioners enable you to do down-hand welding on any part of the weldment, top, bottom, sides—to produce more uniformly perfect welds—stronger joints, smoother, neater fillets and beads which require less grinding. Eliminates handling delays, converts "handling time" into "welding time"—saves crane service, saves floor space. Table revolves a full 360°, tilts up to 135° beyond horizontal, and is adjustable for height. Models taking up to 30,000 lbs., handle wide range of work, handle larger unbalanced loads. Hand or push button operation. These are universal tools—pedestal or boom mounted to give maximum floor and working clearance.

Write for Bulletin WP—22

CULLEN-FRIESTEDT CO., 1309 S. Kilbourn Ave., Chicago 23, U.S.A.

## *Bank on Sight Feed!*




● Yes, sir, *bank* on Sight Feed—and you can take that *two* ways:

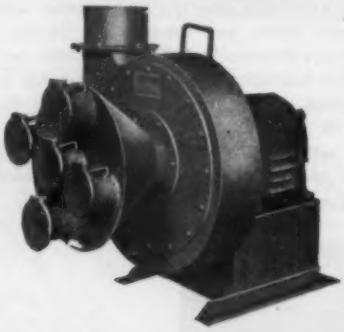
**1.** You can *count on* Sight Feed for an assured source of purer, hotter acetylene gas. Sight Feed never lets you down.

**2.** You can *bank* more dough with Sight Feed. For countless users report savings *up to 75%* in acetylene cost. An amazing economy, year in and year out.

Order your Sight Feed today—10 models, portable and stationary.

THE *Sight Feed* GENERATOR COMPANY • SALES: RICHMOND, IND. • FACTORY: W. ALEXANDRIA, O.

# "GENERAL" WELDING FUME EXHAUSTERS



For effective elimination of the *Noxious Fumes* from

**Arc Welding**

**Galvanized Iron Soldering**

**Spray Painting, Etc.**

**TWO TO TEN INLETS—**

For multiple hose connections in shop and field operations.

**SINGLE INLET UNITS—**

For exhaust from booth collector ducts; and in the smaller units.

**High Velocity Exhaustion by High Speed Centrifugal Fans for Small, Easily Handled Hoses**

**SEMI-PORTABLES—**

Movable by crane hook or carrying bar; or for fixed (duct) service. ¾ to 15 motor horsepower.

**PORTABLE "JUNIORS"—**

40 to 100 pounds in weight; one or two inlet nozzles.

Self-closing caps on all nozzles.
Rugged, all-steel construction.
Motored for continuous service.
Controls protected within base.

*Bulletin CB-103 gives specifications and dimensions for the 28 types and sizes comprising the "General" line.*

**GENERAL BLOWER CO.**

403 N. Peoria St., MONroe 0244
New York CHICAGO 22, ILL. Detroit
Pittsburgh Philadelphia Cleveland


### "Welding Stainless Steels"

No booklet more attractive could possibly be printed than the 68-page, letterhead-size, "Welding Stainless Steels" published by **Allegheny Ludlum Steel Corp.**, Brackenridge, Pa. The generous use of colors and the beautifully drawn, large-size illustrations render this book a genuine work of art by any printing standards. The text perhaps suffers a trifle from the contrast with the spectacular colored drawings, yet it does a clear, readable job of providing the basic facts of stainless steel welding.

The book begins by discussing the effects of heat on stainless steels, taking up in detail the two chief branches of the family: chromium-nickel steels and straight chromium steels. Charts contrasting the electrical resistance, thermal conductivy, coefficient of expansion and melting point of plain carbon steel, a chromium-nickel type and a straight chromium steel are then presented. The welding information which follows covers all of the forms of stainless steel welding being used today: metal-arc, automatic submerged melt, atomic-hydrogen, oxy-acetylene and various resistance-welding processes such as spot welding, projection welding, series spot welding, multiple spot welding, seam welding and flash welding. Some information is also given on the welding of stainless-clad steels.

» «

### Regulator Information

"Regulators—How to Save, Protect, Repair Them" is the lengthy title of a not-too-long and highly amusing 6 by 9 in. booklet. This treatise begins with the picture of a Scotchman saying, "Free Ideas. They Dinna Cost You Nothing," and continues in the same vein throughout most of its 28 pages. For example: "It dropped in the MUD . . . oh . . . oh! That's bad. Mud, dirt, sand and grit are as hard on your regulator as they are on a good watch. You're in for a cleaning job."

The breeziness of the text is enlivened still further by two-color cartoons, one or two of which appear on almost every page. In spite of—or perhaps because of—its informal style, however, this little booklet does an excellent job of presenting the basic facts of regulator care and maintenance. **Smith Welding Equipment Corp.**, Minneapolis 14.

» «

### Electric Hoist Bulletin

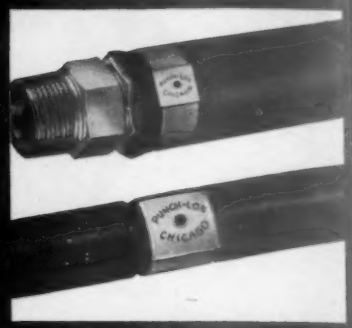
An eight-page, two-color, letterhead-size bulletin, No. H-23, furnishes operating and construction details of the new 500 lb electric chain hoist recently added to the P&H line. **Hoist Division, Harnischfeger Corp.**, Milwaukee 14.

» «

### Rotary File Catalog

A 34-page, plastic-bound, letterhead-size catalog features the full line of standard shapes in hand-cut rotary files made by **The Rotary File Co.**, Stratford, Conn.


# PUNCH-LOK *Streamlined* HOSE BANDING METHOD



**SPEED-SAFETY-ECONOMY In Clamping-Splicing-Repairing-Mending-Tieing-Reinforcing**

PUNCH-LOK Streamlined Hose Banding Method is being used in hundreds of production and maintenance jobs in all industries for connecting high-pressure hose; splicing electric cable; stopping leaks in steam and water lines; reinforcing and mending splits in cross-arms and ladder rails; tieing rigid conduit or flexible cable to existing pipe lines or girders; tieing ends of wire or manila rope to prevent fraying—and many other jobs. PUNCH-LOK is giving wartime industries a fast, safe, economical, quality banding method. Investigate NOW the many advantages it will have for you in your present and postwar work. Let PUNCH-LOK solve your clamping or banding problems!

**CLAMPS** . . . Made of flat, high tensile, galvanized steel, double wrapped. Available from ⅜" to 48" I.D. Any large size clamp can be pulled down and made into a smaller size.

**LOKING TOOL** . . . Sturdily constructed to assure long life. Locks all size clamps with a tensional pull of 1,000 lbs. Hammer punches and breaks excess band flush at clip.

**GROOVED FITTINGS** . . . For water or steam lines. Permits application of high pressure clamping without damage to hose.

*Write for Descriptive Catalog and Name of Local Distributor*

**PUNCH-LOK COMPANY**

Dept. E, 321 N. Justine St.
Chicago 7, Illinois

EASY-FLO fabricated Air Speed Indicator Part. 6 joints in upper assembly brazed simultaneously—then 10 in lower. EASY-FLO rings preplaced at all joints.

# EASY-FLO RINGS

## "WED" METALS TOGETHER FOR KEEPS

It's the fashion today to join metals with preplaced rings of EASY-FLO silver brazing alloy wire—first, because low-temperature EASY-FLO means fast, reliable, low-cost brazing—second, because preplacing the alloy speeds production, gives accurate control of amount of alloy and assures uniform distribution throughout a joint—and finally, because metals joined by EASY-FLO will never be parted by vibration, shock or extremes of temperature. They're one for keeps. START NOW to get the benefit of EASY-FLO's speed, reliability and economy in your metal joining operations present and future. **BULLETIN 12-A** tells you how. Write for your copy today.

**STEEL SALES CORPORATION**

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3348 S. Pulaski Road Chicago, Illinois Milwaukee Memphis

Easy, Safe, Quick Handling of Dies . . . Up to 30,000 Lbs.

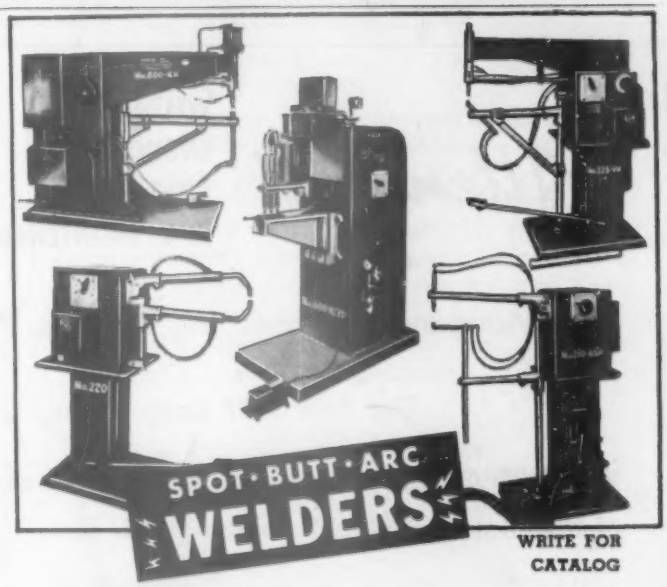
# LYON-Raymond HYDRAULIC TRUCKS

• Safety, maneuverability, ease of handling, can best be served by the Die Handling Truck that exactly fits the conditions of *your* specific problem. Lyon-Raymond, specialists in *hydraulic* material-handling devices, offers the most complete line of Die Handling Trucks — a line comprehensive enough to include the model with the capacity and other specifications to perform *your* task best. Before selecting a Die Handling Truck, be sure to look over the Lyon-Raymond line. Send for our new bulletin, "Die Handling Made Easy" describing a wide variety of models.

30,000 lbs. capacity; Gasoline Engine Drive for pump.

2,000 lb. capacity Table

**LYON-RAYMOND CORPORATION**
**351 Madison St.**
**Greene, N. Y.**




**WRITE FOR CATALOG**

We manufacture a complete line of resistance spot welders from ¼ to 300 KVA for all types of welding. There is an EISLER WELDER for every purpose.

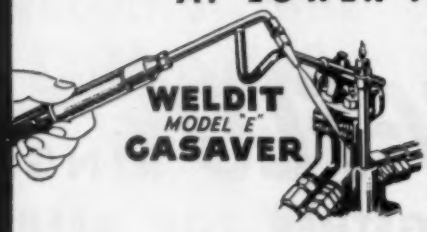
**TRANSFORMERS OF ALL TYPES**

**WE INVITE CONTRACT SPOT WELDING IN LARGE OR SMALL QUANTITIES.**

**CHAS. EISLER**
**EISLER ENGINEERING CO.**
749-SO. 13th ST. Near AVON AVE NEWARK N. J.

# Safe Welding

## AT LOWER PRODUCTION COSTS




The Weldit Gasaver shuts off the welding flame when not in use. . . . Conserves essential materials by cutting oxygen and acetylene consumption as much as *fifty* per cent. Prevents injury to workmen—or sudden fires—from dangerous idle torch flames. . . . Adjustment remains unaltered between welds.

When the Weldit Gasaver has been installed, you simply hang idle torch on the handy lever rod. Weight of torch pulls rod down, thus automatically shutting off supply lines. Relight instantly by passing torch over Gasaver pilot light. No bother. . . . No time lost. . . . *No readjusting required.* . . . Price $10.00 at Detroit. Order today.

## *Better Soldering, Annealing and Heating Jobs*

The Weldit Model CW Blowpipe is in daily use by many foremost industrial plants. . . . Built in accordance with the recommendations of leading fabricators of sheet metal products. . . . Operates on either natural gas, manufactured gas, or other low temperature fuel gas and compressed air. Stands up under rough shop use. . . . Send for literature.

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*Get Your FREE Copy of the*

**WELDERS GUIDE, sensational all-purpose newspaper. It also contains a beautiful photograph of**

*The Welders' Pin Up Girl*

***Write For It Today***

# STULZ-SICKLES CO.

**255 - 9th St., San Francisco 3, Calif.**
**134 Lafayette St., Newark 5, N. J.**


### Welding Fitting Catalog

To meet requests for a book giving the welding fitting dimensions specified in Naval and maritime shipbuilding, **Tube Turns**, Louisville, Ky., has brought out its maritime fittings catalog No. 112. Section 1 of this 48-page, plastic-bound book contains dimensional data on seamless wrought steel and wrought iron fittings. Section 2 gives similar data on fittings of wrought carbon-molybdenum-alloy steel. Each section is fully indexed.

» «

### "Nervous Weld" Bulletin

A four-page, letter-head size, two-color bulletin, "Salvage Defective Aluminum Castings," gives information on the Mogul "Nervous Weld" process (see also page 70) and illustrates and describes the pistol and weld machine required. "Before-and-after" pictures of a casting reclaimed by this process are also included. **Metallizing Co. of America**, 1330 West Congress St., Chicago 7.

» «

### Welsh Catalog

**Welsh Mfg. Co.**, 64 Troy St., Providence 9, has just issued a new catalog covering weldors' and chippers' goggles and weldors' helmets and hand shields. Both eye-cup-type and spectacle-type goggles are included, and there is also a section devoted to "Welshard" superhardened and "Welshade" hardened absorptive lenses.

» «

### WALCO Catalog

A 12-page, letterhead-size catalog has just been issued to show the products manufactured and distributed by the **Welding Alloys Mfg. Co.**, 744 Broad St., Newark 2. These include a line of arc-welding electrodes, flux-coated filler rods and fluxes to use in welding aluminum by both the arc and gas methods.

» «

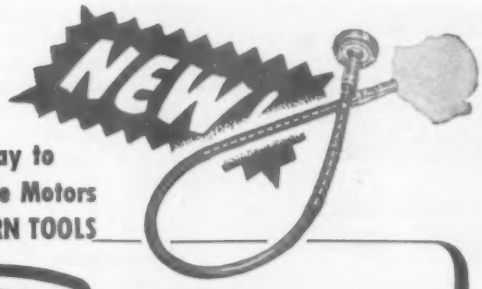
### Navy Salute

A broadcast salute by the United States Navy to the **Ergolyte Mfg. Co.**, 3627 N. Lawrence St., Philadelphia, has been interestingly presented in an attractive six-page booklet, "The United States Navy Salutes Ergolyte." The front and back covers feature an action scene showing ICVP boats setting out for enemy-held shores while the inside pages present the script of the broadcast, which was delivered in recognition of Ergolyte's production record on ICVP landing craft.

» «

### Fire Fighting Data

"Sharpshooting at Flames," is the title of a 16-page, 5½ by 8½ in. pamphlet, R-5827, that graphically portrays the latest techniques developed to fight fires with carbon dioxide extinguishers. **Randolph Laboratories, Inc.**, 8 East Kinzie St., Chicago 11.




An Easy Way to Convert Idle Motors into MODERN TOOLS

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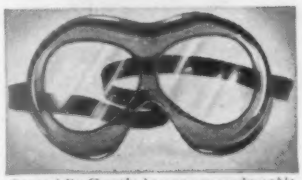

*Cover-Lite* Goggle lenses are *replaceable*

• As you're looking through these new CESCO *Cover-Lite* Safety Goggles you're practically experiencing their comfort, too. When you actually have them on, you scarcely know they're there.

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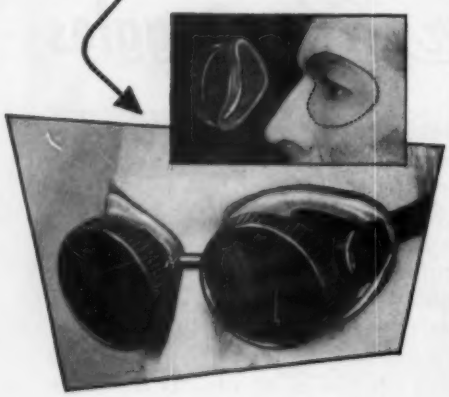
# Outstanding for FIT



For heavy and light welding operations and observation, smelting work, heating furnaces, etc., workers have shown great appreciation of Willson's RW50 Welding Goggles. The comfort they get from superb fit is a big reason why.

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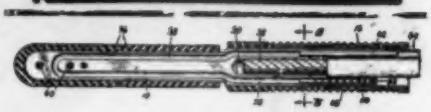
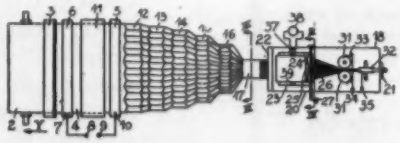


### *Fluid-Cooled Electrode Holder*

2,350,614. **Honel A. Jackson**, Detroit. Filed June 10, 1942. Issued June 6, 1944.

An electrode holder having an electrically conductive member connected at one end to an electric cable while the other end is adapted to serve as an electrode-gripping jaw. Insulation material partially encloses conductive member and defines with it a cooling-fluid passageway arranged between the insulation material and member. A means is also provided for delivering fluid through the passageway in order to cool the conductive member and the insulation.

» «



### *Welding Electrode*

2,350,387. **Camillo Cito**, Uccle-Brussels, Belgium; vested in the **Alien Property Custodian.** Filed Feb. 7, 1941 (in Belgium Jan. 26, 1940). Issued June 6, 1944.

A process of making a welding rod or electrode of desired cross-section by longitudinally folding a sheet of relatively thin sheet metal so as to define several longitudinal channels on one side of the sheet. These channels are filled with pulverized material, and the resultant is compressed to reduce the apertures of the channels and compact the additive material. The compression is performed in a manner to cause portions of at least two channel walls to extend across the mouths of the channels and touch. Simultaneously, the touching wall portions are welded together to form a sealed casing that will prevent access of outside air to the additive material within the channels.

» «

### *Welding Method*

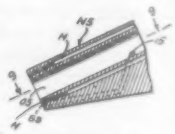
2,350,532. **Edward A. Richardson**, Bethlehem, Pa. Filed June 4, 1941. Issued June 6, 1944.

A method of welding hardenable materials in order to obtain desired physical properties in the weld and heat-affected zones. A transformation temperature that will yield the desired properties is first established in at least those portions of the material which will be heat affected by the welding operation. The weld is made; before it has cooled substantially, heat is rapidly withdrawn from the weld joint and the heat-affected regions adjacent so as to bring the temperature to the predetermined transformation temperature as quickly as possible, before transformation at any other temperature can be substantially complete. The transformation temperature is then maintained until the desired transformation has been completed.

» «

### *Deseaming Torch*

2,349,902. **James H. Bucknam**, Cranford, N. J., assigned to **Union Carbide and Carbon Corp.** Filed Jan. 14, 1939 (original application). Issued May 30, 1944.



A torch with an elongated body member having an outer end face from which opens a relatively large longitudinal bore for discharging a main jet of oxidizing gas obliquely against and along a work surface to form an undercut space. A pair of relatively small bores, each opening at its inner end to the large bore, extends downwardly and laterally and then forwardly and inwardly toward the outer end face of the body member. The small bores, opening at their outer ends to the face, discharge auxiliary jets of oxidizing gas obliquely against and along the work surface at the margins of the undercut space. The angle of impingement and the velocity of the auxiliary jets is substantially less than that of the main jet.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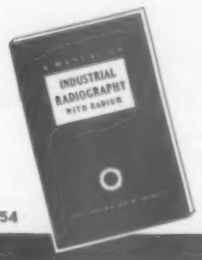


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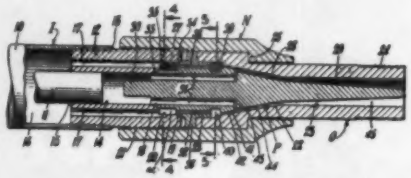
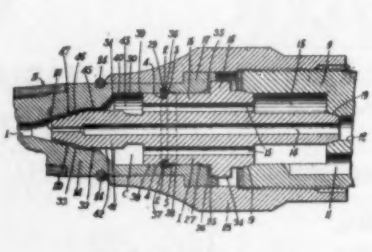
### *Welding Torch*

2,348,839. **Samuel R. Oldham,** Newark, assigned to **Union Carbide and Carbon Corp.** Filed Jan. 28, 1941. Issued May 16, 1944.



An injector-type torch mixer provided with a frusto-conical passage terminating in an annular injector orifice for one gas while another gas is caused to flow radially toward the orifice from an annular, axially narrow outlet passage. The frusto-conical jet of gas is adapted to be discharged into a relatively long frusto-conical gas mixing chamber. The radial width of the gas mixing chamber is substantially greater than that of the injector orifice. The mixing chamber merges into a relatively long annular discharge chamber for the flow and further mixing of gases discharged from the mixing chamber; the connection between mixing chamber and discharge chamber is entirely unrestricted.

» «



### *Welding Torch*

2,348,774. **Clifford C. Anthes,** Union, N. J., assigned to **Union Carbide and Carbon Corp.** Filed Aug. 3, 1940. Issued May 16, 1944.

A torch comprising, in combination, a tube having at one end a cylindrical surface of constant diameter extending forwardly from the end, an annular groove having a frusto-conical cam surface extending outward and forwardly from the cylindrical surface and an annular wall extending inwardly from the cam surface. A cylindrical surface of constant diameter extends forwardly from the wall, and a frusto-conical surface extends inwardly and forwardly from the cylindrical surface. A cylindrical surface of constant diameter extends forwardly from the last-named frusto-conical surface, and another frusto-conical surface extends inwardly and forwardly from the last-named cylindrical surface. A plug having a cylindrical surface of constant diameter fits the corresponding surface of the tube. An annular groove has parallel side walls, the forward one of which is in the plane containing the wall of the groove in the tube. A cylindrical surface of constant diameter extends from the wall and terminates in spaced relation to the forward end of the corresponding cylindrical surface of the tube.

A nozzle having its outer surface spaced from the inside of the tube provides an annular gas distributing chamber; this nozzle has a cylindrical outer surface of constant diameter spaced from the corresponding inner surface of the tube to provide a cylindrical gas passage; the nozzle also has a frusto-conical end portion spaced from the corresponding frusto-conical inner surface of the tube to provide a frusto-conical gas passage extending from the cylindrical gas passage. The tube has an axial gas passage extending through the nozzle and a plurality of longitudinal gas passages opening to the gas distributing chamber.

The previously mentioned cylindrical plug is subject to undesirable rotary and lateral movement, which movement with respect to the tube is inhibited by a polygonal split spring ring fitting the grooves. Plug and spring ring may be withdrawn from the tube without damage to any of the other parts.

» «

### *Welding Rod*

2,349,945. **Louis C. Dodd,** Buffalo, assigned to **Magnus Metal Corp.,** Chicago. Filed April 2, 1941 (original application). Issued May 30, 1944.

A welding rod consisting predominantly of copper and containing tin from 1.0 to 8.0%, nickel from 0.1 to 1.0% and lead from 3.0 to 20.0%.

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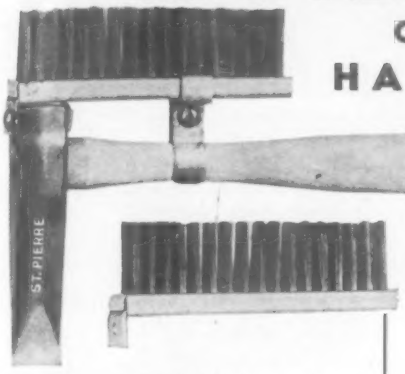


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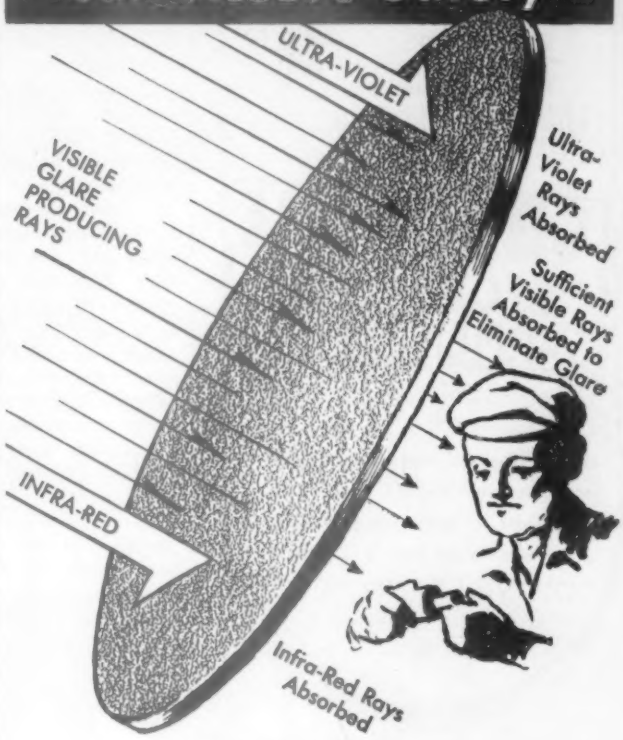


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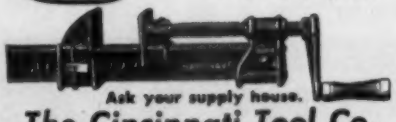

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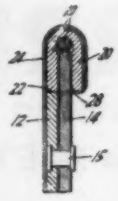
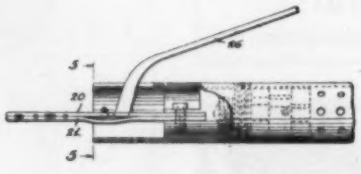
## Electrode Holder

2,347,598. **John L. Foley** and **Daniel B. Malarkey,** Buffalo, N. Y., assigned to **Hobart Sales Service Supplies,** Buffalo. Filed April 7, 1943. Issued April 25, 1944.



An electrode holder comprising a pair of handle portions pivoted together intermediately of their ends. One of the handle members has a reversely turned end portion disposed to overhang the corresponding end portion of the other member when in tool-closed position and thereby enclose upon and grip the end of an electrode. The overhanging handle portion has a rear wall which limits the extent of insertion of the electrode. A metal strip of high electrical conductivity is mounted integrally with and alongside the handle member having the overhanging portion; strip extends about the overhanging portion to reinforce it and to conduct welding current from the lower end of the handle into the overhanging jaw portion. An electrical connection means is provided at the lower end of the handle for detachably connecting an electrical conductor to the corresponding end portion of the metal strip.

» «

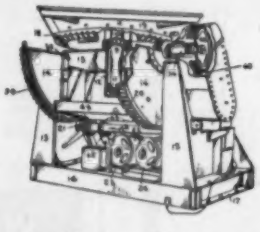


## *Electrode Holder*

2,346,363. **Thomas S. Donnelly, Jr.,** Detroit asigned to **Bordon Mfg. Co. Inc.,** Detroit. Filed Jan. 26, 1942. Issued April 11, 1944.

An electrode holder having a tubular handle, a metallic liner extending over a portion of its inner surface and a shank-forming portion embraced by the metal lining and adapted for attachment to a conductor. Upper and lower jaws project in superimposed registering relation forwardly of the shank-forming portion. The forward end of a downward rocking lever projects through an opening in the upper jaw and is pivotally connected to jaw. Rearwardly of the pivot, the lever engages the lower jaw; this action causes the jaws to spread apart for the reception of an electrode.

» «



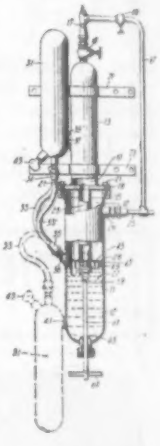
## Welding Positioner

2,348,062. **John P. Faber,** Dunellen, N. J., assigned to **Ransome Machinery Co.,** Plainfield, N. J. Filed Dec. 23, 1942. Issued May, 1944.

A table having means at various points for securing work is mounted upon a centrally fixed pivot member for rotation. Other elements are: a bearing in which the pivot member is mounted to rotate; a yoke by which the bearing is carried; side frames in which the yoke is mounted at its ends to rock on a horizontal axis; segment gears fixed to the yoke on either side of the bearing for rocking yoke, pivot member and table; a connecting member fixed to the segment gears inside their teeth and spanning the space between them. The connecting member is weighted to exceed the weight of the table and therefore urges table and work by gravity to move to the horizontal from all other positions.

» «

## Vapor Flux Dispenser



2,347,498. **Malven L. Olson,** Indianapolis, assigned to **Union Carbide and Carbon Corp.,** New York City. Filed July 20, 1940. Issued April 25, 1944.

Process for dispensing a volatilizable alkyl borate flux within a welding gas. A stream of a moisture-containing welding gas is introduced within a body of hydrolyzable volatilizable flux having a surface continuously maintained at a substantially constant level; gas is introduced at a point near but below the surface level and is flowed along an extended path closely adjacent to the surface of the flux body. This action dries the gas and concurrently impregnates it with the volatile flux. The flux-impregnated gas is withdrawn substantially free from the solid particles formed by the hydrolysis of the alkyl borate flux.

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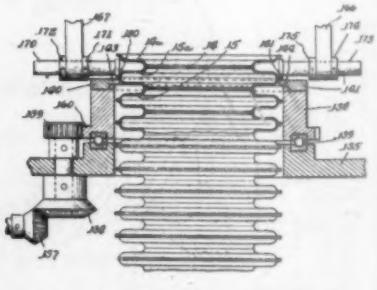

## Seam Welding Method

2,347,185. **David Wendell Fentress,** Hubbard Woods, Ill., assigned to **Chicago Metal Hose Corp.,** Maywood, Ill. Filed Oct. 6, 1939. Issued April 25, 1944.

A method for making a bellows by seam welding the inner and outer peripheral edges of superposed pairs of annular profiled plates.